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Planning and Controlling Production in a French Shop

Engineering Department Responsible for Bills of Material — Cylindrical Control Board Saves Room—Calculagraph Used in Work Distributing Department

BY E. JULLIEN

THE system which will be described in the following pages was devised and installed by the writer, to control the production at the works of Messrs. A. Savy Jeanjean et Cie., in Courbevoie, near Paris.

The works employ a normal working force of about 600 workmen, turning out special machines for manufacturing chocolate, biscuits, soap, etc.

Before starting with the new organization the works were divided into a number of departments and at the

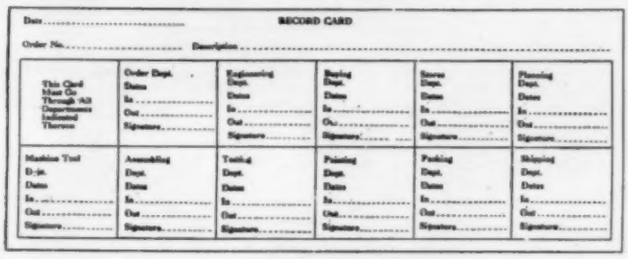


FIG. 1. RECORD CARD

head of each was a foreman. There were two foremen over the machine shop department; the erecting floor was divided into five sections, each section being under the supervision of a foreman.

More than 100 different types of machines were and are still manufactured in the works, each section of the assembling floor having to assemble a certain number of types of machines.

THE MANUFACTURING DEPARTMENT

The manufacturing of all the machines was carried out as follows: A manufacturing order for a certain number of machines of a certain type was sent from the commercial department to the works office, the works manager sent out a note to the assembling foreman of the section in which this particular type of machine had to be assembled, telling him to make so many machines of the type asked for by a certain date. The foreman, on receiving this note, had to find the shop drawings, the material bills in the shop's drawing stores, and find out in the manufactured stores which parts were already machined and available. In the rough stores he had to find the rough parts, forgings, castings, etc., available for the job, then make out a list of the parts necessary to complete the order, send the list to the works manager, who transmitted it to the buying department, indicating the date for which the material and parts were required.

The foreman had to be continually on the look out to see when the parts ordered out came in from the foundry and other sources of outside supply, then he had to issue machining orders to the machine-tool foremen and follow the work in the various departments of the machine shop. In other words, each assembling foreman had to do his own planning, the machine foremen had also to plan out their work in order to give satisfaction to each of the five assembling foremen, with the result that they never had any time to give to the most important part of their duty; give their advice to the workmen in order to get the work done in the quickest and most efficient manner. The men were left to themselves and worked in their own way. Generally the machine foremen did not plan their work in accordance with the urgency but in accordance with the degree of pressure put on them by each individual assembling foreman with the result that some assembling foremen were rapidly served, and turned out a certain number of machines, while others had a very poor output and no end of difficulties.

THE PROPORTION OF OUTPUT

The output was very small in proportion to the capacity for production of the whole plant, and it was absolutely impossible to guarantee the delivery of a machine for any date with a reasonable chance of fulfilling the promise given. At the same time, no hope

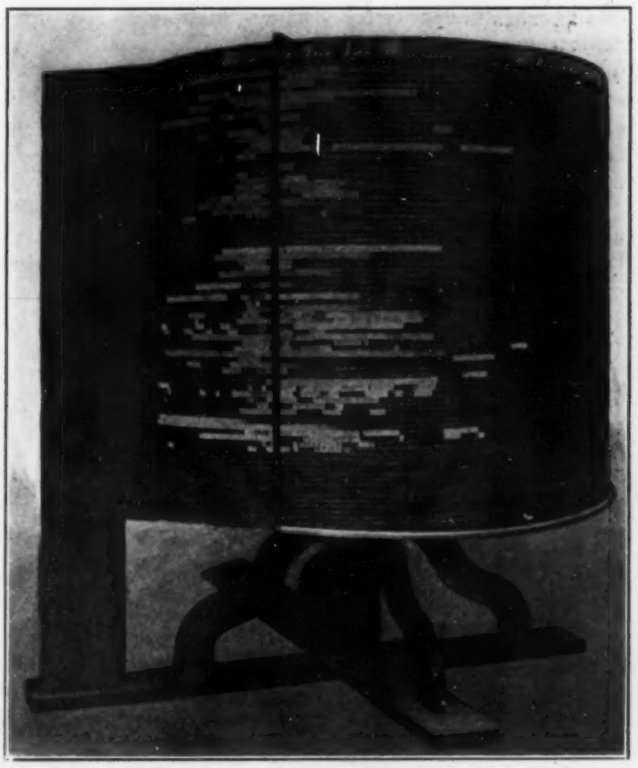


FIG. 2. THE REVOLVING CALENDAR

could be entertained of getting even a very rough idea of the progress of the work in the shops.

When the writer took charge of the plant, he studied the working conditions very carefully and developed a

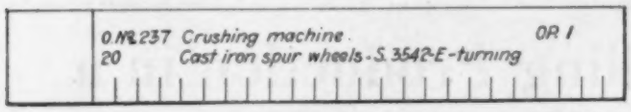


FIG. 3. PAPER RIBBON FOR THE CALENDAR

system for planning, controlling and routing the work through all the departments. The system provides complete records of all the information required to determine the amount of stock in hand and required, the progress of the work and the location of any part of a machine in construction at any time, the cost of any machine, any part or any operation, a few hours after the work is finished.

The New System

Under the new system all orders received from clients are sent to the estimating department where they are compared with the original estimates in order to see if everything is correct with regard to the type of machine, price, date of delivery, payment, etc. If everything is correct, the order is returned to the order department where the order forms are prepared, giving full particulars of the machines to be manufactured, delivery date, packing and shipping instructions and so forth.

When the machines required are intended for stock the order form is made up on paper of a different color and no packing or shipping instructions are given. Each order form is accompanied by a record card (Fig. 1); this card goes through all the departments where the dates both in and out must be filled. When the job is finished, if the time given for completion is exceeded, the record card indicates where delays occurred.

The order is first sent to the engineering and drafting department where all necessary drawings and material bills are prepared. The drawings are made in four sizes and can be folded to the same dimension. Only one part of a machine is shown on each drawing, and as far as possible, one drawing is made for each operation.

The machines are divided into a number of units and assembly drawings are made showing each unit. On these drawings, the symbol of each part is indicated.

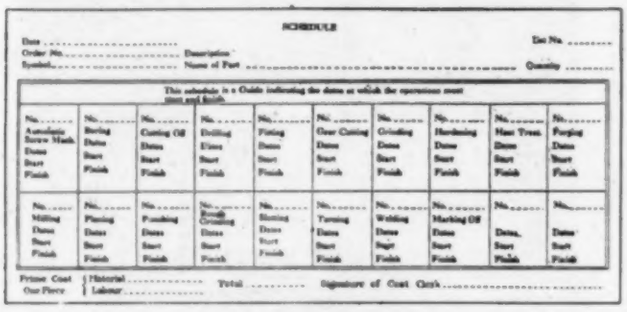


FIG. 4. MACHINING SCHEDULE

The material bills are also divided in units, the name of each unit and its own symbol are specified, the parts are written down in the following order: Steel castings, iron castings, malleable iron castings, bronze castings, aluminum castings, forgings, round steel and other steel sections, bolts, nuts, screws, washers, split pins, keys, etc. The symbol of each part, the drawing number, pattern number if any, the quantity of parts required for each unit, the name of the part and the material, are indicated in the columns provided for that purpose. In the case of bolts, nuts, screws, washers, etc., the size is given, the symbol by which these parts are known in the stores and the parts for which they are used.

Data for the Planning Department

The shop drawings and the material bills are sent to the planning department with the record card. The progress clerk attaches one progress sheet to each sheet of the material list, and writes in the first column the number of parts necessary to fill the order. The copy of the material bills with the progress sheets attached, is sent to the stores, where the number of rough parts and quantity of material available in stock will be marked in the second column by the stores clerk, who will also mark in the last column the number of finished parts which can be taken from stock; these parts are

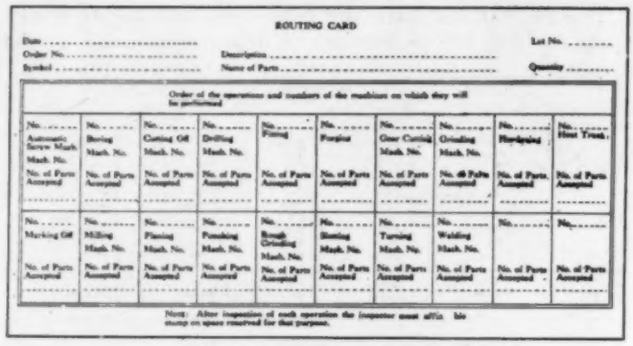


FIG. 5. ROUTING CARD

then reserved, and cannot be used for anything but that particular order. The quantities reserved are marked on the stock cards with the date and the order number. The difference between the number of parts necessary and the number available in stock is written in the third column.

The material bills with the progress sheets so far filled in, are sent to the buying department where orders are issued for the parts necessary to complete the machine. The name of the firm where the parts and material have been ordered from, the date, order number and probable date of delivery, are filled in the columns provided for that purpose. The material bills and progress sheets filled in are sent back to the planning department, where the work can now commence.

The delivery date has been indicated on the order form and everything must be done to have the machine ready for that date; every part of the machine must be finished and ready for assembling at a certain date, to allow the necessary time to assemble, test, paint and pack if necessary. Each part of the machine is studied with regard to the method of machining, machines on which the work must be done, tools and jigs required and time necessary for each operation. A time sheet is then prepared as well as a tool sheet and an instruction sheet.

To determine on which machine and when the work shall be done, a revolving calendar, shown in Fig. 2, has been provided. The calendar is a wooden drum which can easily be revolved around a vertical shaft socketed in a strong support forming a stand.

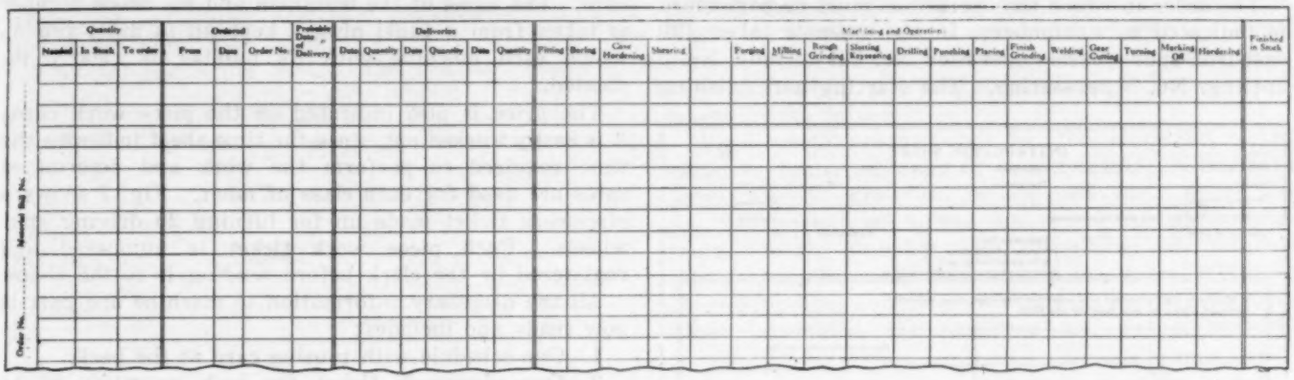


FIG. 6. PROGRESS SHEET

The circumference of the drum is divided in six equal divisions, each division representing one month. Each month is divided in 31 days, 31 divisions being necessary on account of the changing over taking place at the end of June. Black vertical lines indicate the divisions in months and days, the month lines being much thicker than the day lines. On a vertical board fixed on the standard, and at the side of the drum, vertical divisions are made, each division corresponding to one machine in the shop, all the machines being written down with their designation and number. Opposite each division on the board there is a copper strip nailed on the drum in such a way that a ribbon of paper can be inserted between it and the drum.

Supposing that for an order of twenty machines, twenty cast-iron spur gear wheels are required; on these wheels, there are three operations: (1) Turning; (2) cutting; (3) keyseating. The time required for turning is 1 hr. 10 min. per wheel or 23 hr. 20 min. for the lot: the time required for cutting is 1 hr. per wheel or 20 hr. for the lot; the time required for keyseating is 6 min. or 2 hr. for the lot. After each operation, a certain time must be allowed for inspection, trucking, etc., say two hours, then the total time required from start to finish is 23 hr. 20 min. + 2 hr. + 20 hr. + 2 hr. + 2 hr. = 49 hr. 20 min. for the complete machining of the twenty spur wheels. These parts will be required by the assembling foreman by a certain date, therefore the three operations will have to be placed in their proper order on machines which are free between the planning date and the date wanted for assembling. For the turning operation, a ribbon of paper will be cut to a length of 24 hours. Ribbons are prepared in advance with the divisions in hours printed on, with 200 working hours in one month, each division being about $\frac{1}{2}$ in. On the ribbon, the order number will be written, the description of the machine, the number of parts, their names and symbols and the number of the operation and its description; see Fig. 3.

This first band represents graphically the time required for the first operation and is placed on the drum opposite the name of a machine suitable for performing the work; this particular machine must be free in time to allow the work to pass to the other operations in time to be finished by the date wanted for assembling. The same thing will be done for all the other operations and for all the parts necessary to assemble the machines called for on the order form. It is necessary to leave a small margin between the finishing and the starting time of the operations to allow for inspection, trucking and unavoidable and unforeseen delays which might occur.

Using the Calendar

When the machining of a lot of parts is set on the calendar, the starting and the finishing time for each operation can be easily read, the dates being printed on the top of each vertical column representing one day. The work can be scheduled accordingly and the routing cards can be prepared in accordance with the schedule. For this purpose, printed cards are used, one side is intended for the schedule, the other side for the routing. A space is provided on each side for the date, order number, description, number of parts required, name and symbol of parts, etc. The schedule side of the card is shown in Fig. 4. Twenty small rectangles are provided in which the names of all the operations which may be done in the works are printed in alphabetical order.

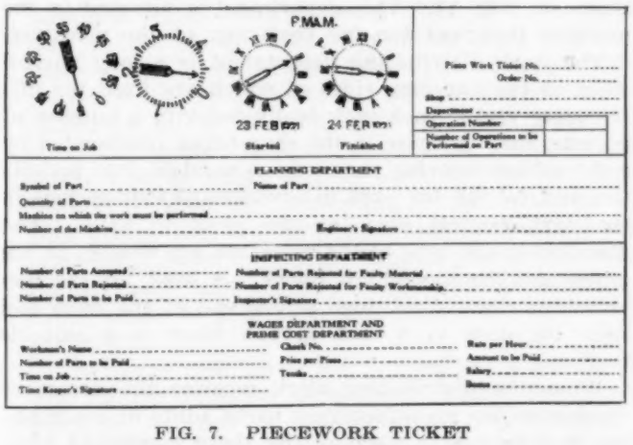


FIG. 7. PIECEWORK TICKET

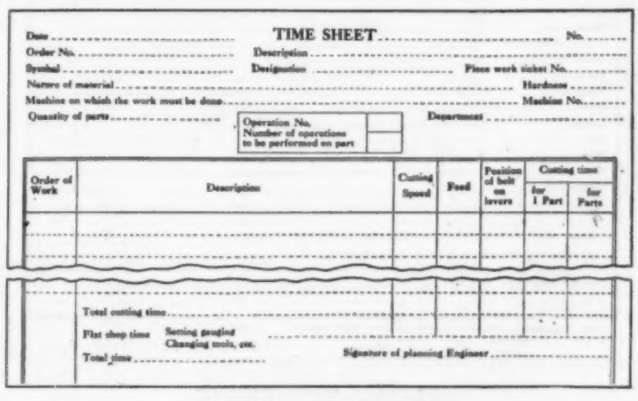


FIG. 8. TIME SHEET

The order in which the operations must be performed is indicated by a number. In the example taken (20 cast-iron spur wheels) operation No. 1 is turning, No. 2 cutting, No. 3 keyseating. The starting and finishing

INSTRUCTION SHEET

Date ..... No. .....
Order No. ..... Description .....
Symbol ..... Designation ..... Piece work ticket No. .....
Nature of material ..... Hardness .....
Machine on which the work must be performed ..... Machine No. .....
Quantity of parts ..... Operation No. / Number of operations to be performed on part ..... Department .....

1° Make sure that the machine is in proper working order, clean, and well lubricated, tighten the belts, study the time sheet.

Sketches showing how the work must be set

2° Set the machine and the work according to sketch .....
3° Use the speeds and feeds indicated on time sheet .....
4° Cutting lubricant to be used .....
5° Don't force the plugs or gauges .....
6° Special instructions .....

Signature of preparator .....

NOTE.—If the speeds and feeds indicated on time sheet cannot be obtained, the machine or the tools are not in order—Tell the foreman.

FIG. 9. INSTRUCTION SHEET

dates for each operation are indicated in the spaces provided for that purpose.

On the back of the schedule is the routing card Fig. 5. This card is very similar to the schedule; it is also divided into twenty small rectangles each one bearing the name of one operation that may be performed in the works; the operation number must also be indicated as well as the number of the machine on which the work is to be done, spaces being provided for that purpose.

From the schedule so prepared, the progress clerk gets all the necessary information to fill in the progress sheet (Fig. 6), the operations to be performed on each part. On the progress sheet, one column has been provided for every operation marked on the schedule. All the clerk has to do is to mark in red and in their proper

TOOL SHEET

Date ..... No. .....
Order No. ..... Description .....
Symbol ..... Designation ..... Piece work ticket No. .....
Nature of material ..... Hardness .....
Work to be performed on ..... Machine No. .....
Quantity of parts ..... Operation No. / Number of operations to be performed on part ..... Department .....
To be prepared for (date) .....

Jigs No.	
Turning tools	
Formed tools	
Knurling tools	
Tool holders	
Planing tools	
Slotting tools	
Milling cutters	
Arbors	
Boring tools	
Boring bars	
Drills	
Reamers	
Taps	
Dies	
Gear cutters	
Cutting tools	
Various tools	
Templets gauges and jigs	

NOTE.—Description and dimensions of tools to be clearly indicated. Signature

FIG. 10. TOOL SHEET

places the numbers indicating the order in which the operations are indicated on the schedule.

The piece-work tickets can now be prepared, one for each operation. All the necessary information to fill in these tickets is found on the schedule and routing card. The name of the workman and his check number is taken from a panel always kept up to date, and on which each machine with its number is clearly indicated.

The price is also indicated on the piece work card; it is easily worked out, since the time sheet indicates the time required to perform the work and determined rates are used for each class of labor. Fig. 7 shows a piecework ticket made up for turning 20 driving spur wheels. Each piece work ticket is numbered and registered by the clerk before sending it to the shops.

All the necessary information to machine one part is now ready and includes:

1. One schedule with routing card at the back.
2. One piecework ticket for each operation to be performed (Fig. 7.).
3. One time sheet for each operation to be performed (Fig. 8).
4. One instruction sheet for each operation to be performed (Fig. 9).

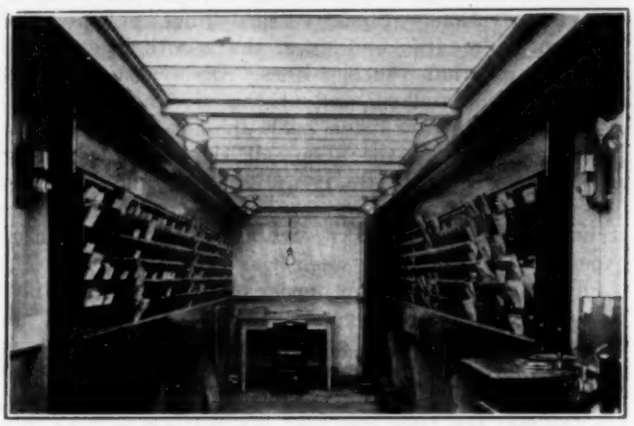


FIG. 11. WORK DISTRIBUTING DEPARTMENT

5. One tool sheet for each operation to be performed (Fig. 10).
6. One drawing (or one drawing for each operation when necessary).
7. One requisition ticket to obtain from the stores the parts or rough material to be machined (Fig. 11).

The documents prepared in this manner for each part and each unit of each type of machine to be manufactured, are sent to the work distributing department shown in Fig. 11. This department is situated in the machine shop, not too far from any of the machines.

The work distributing department is a long narrow room on the two long sides of which are fixed the distributing racks; each rack is divided into a number of pockets, each machine in the shop being represented by eight pockets bearing the machine number, four pockets in a vertical row for work in advance and four pockets in the next vertical row for the work in hand. The description and type of the machines are written in big letters on the top of the board. A desk for the distributing clerk is provided at one end of the room and near his desk is a calculagraph fixed in a suitable manner.

When the distributing clerk receives the necessary documents for manufacturing parts, units or machines, his first duty is to place all the above mentioned documents in the pockets according to the information given on the schedule and piece-work tickets. He leaves out the stores requisitions and the tool and jig sheet; he sends the stores requisitions, Fig. 12, to the stores,

where the material or parts are prepared according to instructions and date given.

The tool sheets are sent to the toolroom where the

STORES REQUISITION

PLANNING DEPT. AND STORES

Date ..... Lot No. .....
Order No. ..... Description .....
Symbol ..... Name of Part .....
Quantity ..... Weight of One Part ..... Total Weight .....
Pattern No. .....
(If Required) .....
Section ..... Dimensions ..... (If taken from Bar)
Length to Cut ..... Number of Pieces. ..... Total Weight .....
Material .....
To be Prepared for (Date) ..... To be Delivered to ..... Signature
Machine No. .....
Taken from Bin No. ..... By .....
Delivered to the Shop (Date) ..... Storekeeper's Signature .....

PRIME COSTING DEPT.

Price per Pound ..... Weight ..... Total Price .....
Price per Piece ..... Quantity ..... Total Price .....
Signature of Cost Clerk .....

Note: When the material or parts are delivered to the shops this requisition form must be sent to the stores clerk, afterwards to the Prime Cost Dept.

FIG. 12. STORES REQUISITION

tools, jigs and gages are prepared according to a date given on the sheet. On the tool sheet the machine on which the work is to be done is indicated.

Two hours before a workman has finished his work, he must advise his foreman who gives warning to the inspector and the distributing clerk. The inspector inspects the work near the machine. If he finds any defects which can be made right, this must be done at once and the work inspected again. When all is in order, the inspector stamps the routing card with the date stamp in the space provided for that purpose and indicates on the piece work ticket the number of parts accepted and rejected for faulty material or workmanship.

When the distribution clerk is advised that a workman is about to finish his work, he must look on the board for the next job to be put on the workman's machine. This is easily done as all the pockets on the board bear a machine number. He makes sure that the material and tools are ready and gives instructions to the stores and to the toolroom to send the material and tools to the machine which is about to change work. The trucking instructions are on the routing card. When the operation to be performed is a first operation, the material or rough parts must be taken from the stores and trucked to the machine specified on the card. In case of a second, third, fourth, etc., operation, the inspector's stamp indicates which operation is finished and where the parts are located.

As soon as his work is passed by the inspector, the workman brings his piece work ticket and the routing card to the work distributing department and gives them to the distributing clerk. The routing card is placed on the trucking board. The piece work ticket is passed on to the calculagraph and the finishing date, time, and elapsed time are printed on. The workman receives in exchange a piece-work ticket, time sheet, instruction sheet and a drawing for his next job. Before giving him the new piece-work ticket, the clerk passes it through the calculagraph to print on the starting date and time. The workman returns to his machine, where he finds tools, gages, jigs and material for his new work.

The piece-work cards for finished work are handed over to the progress department, where the finished work is recorded on the progress sheets, which is simply done by writing near the operation number the quantity of parts finished at that operation.

From the progress department the piece-work cards are taken to the pay clerk and from there to the prime costing department.

When the last operation on one part is finished the routing card is returned to the planning department, where the scheduled dates are compared with the actual dates. When delays have occurred the reason must be found and, if possible, steps taken to prevent such delays in the future.

When parts are rejected by the inspector owing either to faulty material or workmanship, replacement cards, Fig. 13, are filled in and new parts made, the cost being charged to the job or, if the material is faulty, to the foundry. By consulting the progress sheets it can be easily seen when a job is ready for the assembling floor and the assembling order can be issued. When assembled, the machines are tested, painted,

REPLACE PART ORDER No.

INSPECTING DEPT.

Date .....
Order No. ..... Lot No. .....
Symbol of Part ..... Pattern No. .....
Number of Parts to Replace .....
Faulty Material or Workmanship .....
Inspector's Signature .....

WORKS OFFICE

Parts to be Replaced by .....
Cost to be Charged to .....
Signature .....

PLANNING DEPT.

Material to be Prepared .....
Section ..... Dimensions .....
Length to Cut ..... Number of Pieces .....
Signature .....

STORES

Parts to be Delivered to Shop (Date) .....
Quantity ..... Weight per Piece .....
Total Weight .....
Taken from Bin No. ..... By .....
Storekeeper's Signature .....

BUYING DEPT.

Parts Ordered (Date) .....
From ..... Replace Order No. .....
To be Delivered (Date) .....
Signature of Buying Clerk .....

WORKS OFFICE

This card must be kept by W. O. until the parts are received and put in hand.

PRIME COSTING DEPT.

Price per Pound ..... Total Weight ..... Total Price .....
Price per Piece ..... Quantity ..... Total Price .....
Signature .....

NOTE: When the material or parts are delivered to the shops this replace order form, must be sent to the Stores Clerk.
Afterwards to Prime Cost Dept.

FIG. 13. REPLACEMENT ORDER

packed and shipped according to instructions given on the order form.

From this description it can be seen that losses of time are avoided, the work can be traced through all the channels, and a clear view of the general working and progress of the shops can be obtained at any time; any out of balance in the production can be seen immediately and remedies sought. The cost of any operation, part, unit or machine can be obtained accurately a very short time after the work is finished. The output has been greatly increased, and it has been found quite possible to turn out any machine within a few days of the scheduled time.

Testing Equipment for Pneumatic Motors

Importance of Performance Records for Portable Air Motors—Examples of Testing Equipment in Several Railroad Shops

By J. V. HUNTER
Western Editor, *American Machinist*

THE pulling power of a pneumatic motor is considered by many shops to be a good index of its mechanical condition. When the shop mechanic has occasion to use an air motor to pull a heavy load and finds it will not pull as it once did, or will not pull at all, he complains that it is no longer in a serviceable condition. The fault may be with him or with the motor; if he has taken too heavy a cut it is certainly with him. Where to draw a distinction between serviceable condition and a condition that requires overhauling can be decided only by pre-determined records of motor tests. In order to create true test records for a motor it should be tested when new as it is then presumably in its most efficient condition. Each motor carries a factory number and its performance record should be kept under this number. When a motor is brought back to the toolooom with a complaint it should be tested and checked by its initial record to learn whether or not the complaint is justified.

The shops of many big railroad systems have large quantities of air motors used in overhauling equipment and perhaps more are used in locomotive boiler shops. In most cases, fortunately, the care of these motors has been placed under the jurisdiction of toolroom foremen, who have for some years realized the importance of having records of performance, and testing equipment to ascertain whether or not the motors are up to their standard operating efficiency. In the larger shops the majority of toolroom foremen have built testing equipment for obtaining data on the performance, both of new motors and of motors brought in for repairs.

Methods of Testing Motors

Some modification of the absorption dynamometer seems to be the generally accepted method for testing the pulling power of motors. It is considered more essential to have a motor pull a heavy cut with a reamer than to have it run at high speed and pull a very light cut. It is probably true that a motor with considerable air leakage will have difficulty in pulling a heavy cut while this air leakage will not be so apparent if it is run at high speed on a light cut.

Other foremen consider the air consumption of im-

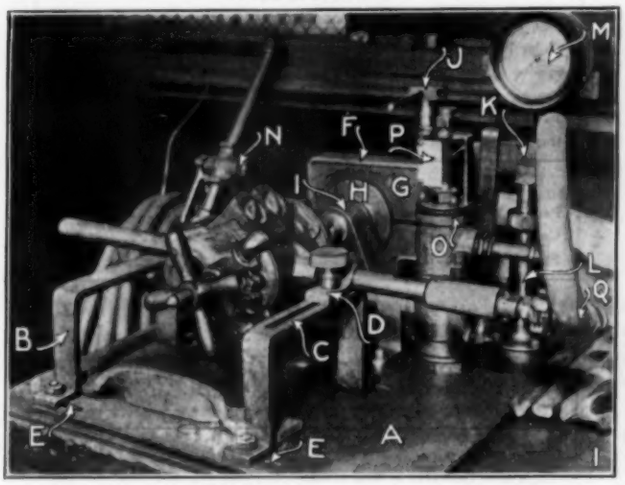


FIG. 1. MOTOR TESTING OUTFIT AT C. & A. SHOPS, BLOOMINGTON, ILL.

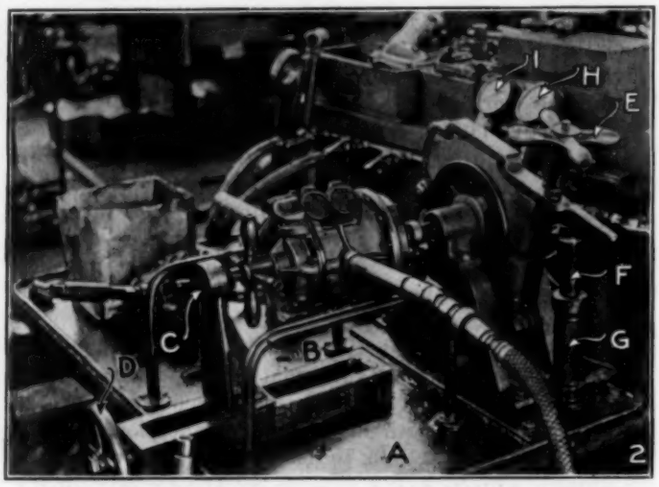


FIG. 2. TESTING OUTFIT AT BEECH GROVE SHOPS OF BIG FOUR AT INDIANAPOLIS

portance. They have, therefore, supplied their testing equipment with air-flow meters so that air consumption can be determined during the brake test.

Testing Device in C. & A. Toolroom

A complete and compact testing outfit is used in the toolroom of the Chicago & Alton R.R. locomotive shop at Bloomington, Ill. All parts of this device, shown in Fig. 1, are mounted on the steel plate *A*. The motor is supported on a frame *B* made of steel bars. The bar at the right *C* is slotted so that the clamping device *D*, for holding one handle of the motor, can be shifted in or out to accommodate different sizes of motors. The bedplate is also slotted at *E* so that the frame can be spread apart when such adjustment is necessary.

The Prony Brake

A form of Prony brake is located at the rear of the frame. It has two steel bands *F* enclosing hard fiber braking blocks *G*, that are used to put the braking pressure on the wheel. The wheel *H* is steel and is mounted on a shaft with a bearing in the bracket *I*. The shaft is driven by a spindle that fits in the tool socket of the air motor.

Pressure on the brake is applied by the screw *J*. The screw applies pressure through a spring which keeps it more uniform and prevents any positive clamping action that might occur due to inequalities in the surface of the wheel or brake. The torque is determined

by means of a hydraulic device. The upper lever arm *K* of the brake extends to a bearing on the end of a piston operating in the cylinder *L*. The cylinder is filled with a fluid, the pressure of which is registered on the gage *M*. The graduations on the gage give a direct reading of the pressure exerted.

The air supply for the motor passes through the pipe *N* into the air meter *O*. It is a Tool-O-Meter made by the New Jersey Meter Co. A direct reading of the rate of air consumption is shown on the gage *P*. A section of air hose *Q* from the right side of the meter is equipped with a quick-acting coupler so that the motor can be rapidly connected for testing.

Motor Testing Outfit at Beech Grove Shops

An air motor-testing outfit that is somewhat similar is installed in the Beech Grove shops of the Big Four Railroad at Indianapolis. The device is mounted on a cast-iron bedplate *A*, Fig. 2. The motor's handles lie on the rod brackets *B*. The motor is further held in place by the bracket *C* which takes the thrust for the feed-screw. To accommodate different sizes of motors the bracket can be moved in or out by a screw controlled by the handwheel *D*. The friction pressure of the brake is controlled by the handwheel *E*.

In this device, also, the torque is determined by means of hydraulic pressure generated by the piston *F* in the cylinder *G*, and registered on the gage *H*. The second gage *I* is for indicating the air pressure on the supply line. An air meter has recently been obtained for this outfit and the foreman is planning its immediate installation. Its operation will be similar to the one used on the testing outfit in the Bloomington shop.

Testing Brake in Decatur Toolroom

An elaborate outfit has been developed and built for air-motor testing in the Decatur, Ill., shops of the

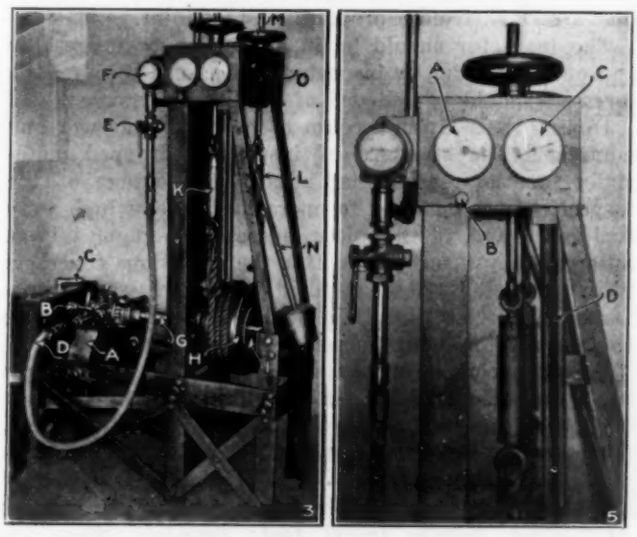


FIG. 3. COMPLETE BRAKE TESTING OUTFIT AND TIMING DEVICE AT WABASH SHOPS, DECATUR, ILL.
FIG. 5. HEAD OF MACHINE SHOWING DIALS FOR INDICATING TIME, REVOLUTIONS AND AIR PRESSURE

Wabash Railway Co. The device, shown in Fig. 3, follows closely the accepted lines of design of a hand or rope brake. The frame is substantially constructed of steel bars and angles. The two handles of the air motor are supported by the adjustable brackets *A*. The motor's feed-screw presses against the adjustable bar *B*. It can be moved in or out for different sizes of motors and locked in place by the screw-clamp handle *C*. A permanent air-hose attachment is provided at *D* and the air supply is controlled by the valve *E*. The air line has the gage *F* for indicating the air pressure.

Construction of Rope Brake

The air motor drives through the shaft *G* that is mounted on ball bearings. Bearings are provided on both sides of the brake drum *H*. The drum is made of an iron spider with a sheet-steel rim and has steel flanges welded to it. The joint between the flanges and the rim are so welded that they are watertight. The flanges extend inside of the rim toward the shaft and have a center opening *I* about 5 in. in diameter.

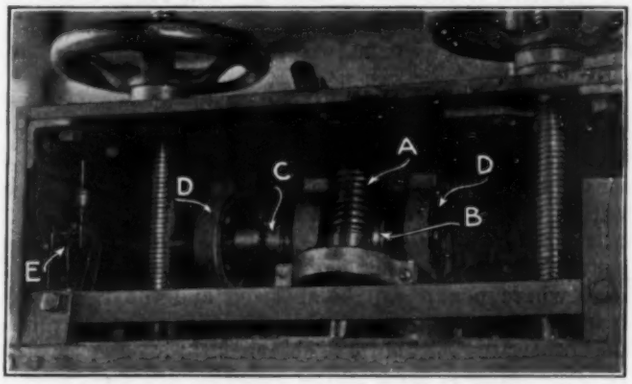


FIG. 4. INTERIOR OF HEAD SHOWING REVOLUTION-COUNTING AND TIMING DEVICES

Through this opening the drum may be partially filled with water, before starting a test. This prevents friction from developing enough heat to burn the rope during a prolonged run at high speed.

Three coils of ¾-in. manila rope inclose the drum for application of the braking friction. The two ends of the rope are spliced into eyes on the lower ends of the spring balances *K* and *L*. The total pull of the friction when the drum is revolving in a counter-clockwise direction (as viewed from the end opposite the motor) will be weighed by the spring balance *K*. The compensation pull is read on the spring balance *L*. This pull represents the tension on the rope and is increased in order to increase the friction on the drum. The pull on the balance *L* must be subtracted from the reading on *K* in order to determine the actual friction pull exerted. The spring balances were made in the shop. Adjustment on either end of the friction rope may be regulated by turning the handwheels *M* that lift the eyebolts from which the spring balances are suspended. These handwheels are mounted on ball bearings so they are more easily turned while supporting a heavy pull of the rope.

An extension of the drum shaft passes through the bearing at the right end and into a small housing. This housing encloses a pair of bevel gears that transmit the motion of the main shaft through a second shaft *N* extending to the compartment *O* at the top of the machine. The shaft operates a revolution counting device that is enclosed in the compartment. A cover on the side may be lowered, exposing the interior mechanism to view as may be seen in Fig. 4. The vertical-drive shaft terminates in the worm *A* which drives a worm

gear on the shaft *B*. This shaft can be connected by a clutch *C* with an extension that drives the revolution counting device. The count of the number of revolutions is shown on the dial *A*, Fig. 5. The small knob *B* is on the end of the rod that operates the clutch shown at *C* in Fig. 4. The convenient arrangement of the rod controlling the clutch enables the counting of the revolutions to be started instantly at the beginning of a test and stopped as quickly at its conclusion.

The shafts in this housing are all mounted on ball bearings *D*, Fig. 4. The ball bearings used were all reclaimed from the turbine units of headlight generators. These bearings are no longer suitable for turbine use when they show a little wear, but are always saved and are very satisfactorily used in all manner of shop equipment.

At *E*, Fig. 4, is a small timing device that counts the duration of the test in seconds. The count is shown by the hand on the dial *C*, Fig. 5. The clockwork is driven by a small weight which slides up and down in the tube *D*.

The timing device is used when determining whether or not the motor makes the required number of revolutions in a given period. The timing device operates constantly and it is therefore necessary to start a test as the second hand reaches zero on the scale. At that point the clutch on the revolution counter can be instantly engaged, and kept in for a certain specified time whereupon it can be released and the revolution reading made. It may be noted in closing that, like the other testing outfits described, the one at the Decatur shops is used, in the majority of cases, merely to ascertain the maximum torque exerted by the motor.

Factory Inspection

BY HARRY H. ARMSTRONG

I have noticed lately different articles on factory inspection and there seems to be many different views on the subject as a whole—by this I mean not only criticism, but even going so far as to wonder if the factory could not do away with inspection entirely, and depend on the supervision of the foreman.

In my experience as a head inspector, I have come across two divisions of foremen and will classify them as mechanical and productive.

The mechanical foreman, in all probability started in as an apprentice and in due time worked up to be a valuable man. An opening came where a foreman was needed and he was given the position on his merit. It is safe to say that this man understands the business, he also knows whether a machine is made right or wrong, and if wrong, can tell what ails the construction. In other words, this type of foreman knows the game and his help recognize it and will try to do their work right. In a department under a foreman of this type inspection can be brought down to a minimum and be confined mostly to checking up the operators and in making sure that the machines are built in accordance with engineering specifications.

The other type of foreman, the productive man, is another proposition; he is there to get the "stuff" out and before he came to be on this job, he may have followed a line of work entirely foreign to that he now is engaged in. One of his operators may ask him a question which he is not able to answer; instead of coming out and saying so, he gives some sort of an answer which perhaps the operator knows is wrong. What happens? The man has got the foreman's number and knows he can fool him. This starts the quality of production on a doubtful road and a good wide-awake inspector is needed in this department. This will be apparent by the number of devices rejected for repairs. In such a case the inspection department is as vital as an oasis in the desert to a tired traveler.

A man may become a good commercial traveler or a barber or a successful insurance agent but he cannot be immediately transformed into a successful shop foreman without first getting the rudiments of mechanics. It is a fact that men of the productive type have asked for and insisted on having competent inspectors in their departments.

Another evil can be brought to the attention of the reader, or perhaps better—the chief inspector; viz.: an inspector of inferior quality should not be placed in a department where the machinists or operators are of a high caliber. It will not take them long to find out the inspector's qualifications and when they discover he is not "there," they regard him as a joke. It is from such cases that the jokes and satires on the inspector spring.

It is obvious that when an inspector holds up a piece of work, he must intelligently explain its defects. However, if he is not sure of his stand and is proved wrong, his standing in the department crumbles and he loses the confidence placed in him.

An inspector should be able to read blueprints and should be able to handle all kinds of measuring tools accurately. He should also be a mechanic and have a good knowledge of practical mathematics. There are some kinds of work in the inspection department where only gages are used but this is only one part of inspection; a gager is not an inspector.

It has been said that the better the supervision is in a department, the less is the need of inspectors. This is true to a certain extent, but it may happen that a foreman may be too precise and worry over details that are O. K. from a production standpoint.

The inspector should be in a position to judge this and once the thing is inspected and passed by him, the foreman should be relieved of needless worry.

During the war, on account of so much gage work on munitions, the standard of inspection dropped materially for the reason that a large percentage of the inspection was confined to operating gages which were fool-proof and if the piece passed the gage, it was automatically inspected. After the munitions contracts were completed, these so-called inspectors were transferred to piecework or laid off, as they could not take the place of real, first-class inspectors.

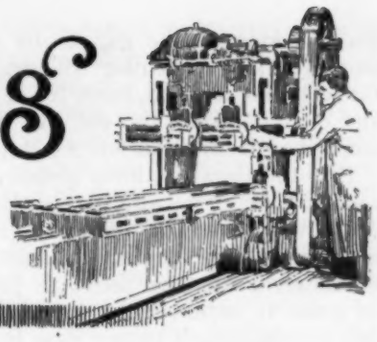
Another complaint against inspection and perhaps the most serious of all is the passing of material unfit for production, or failing to hold up defective work. The greatest criticism comes in at this point and the whole inspection system is called a farce.

In quantity production, the inspector, to keep up with production, has to travel fast; certainly there are chances for a few pieces to get by unnoticed. This can be eliminated by 100 per cent inspection, if the number of defective pieces passed becomes a nuisance.

The inspection department is not infallible; it will make mistakes but it stops myriads of others that would otherwise reach the customer and later reflect on the company in the nature of complaints. It is safe to say that the inspection department will continue actively in the factories for years to come.

Metal Cutting Tools.

By A. L. DeLeeuw



X. Milling Cutters Continued—Gear Cutters—Finishing, Stocking and Duplex Cutters—Various Types of Hobs and Their Action

THOUGH gear cutters are, strictly speaking, form-mills, and though all that has been said about form mills applies to gear cutters, there are a few remarks which should be made because this practice in regard to gear cutters has been so developed and standardized that we can speak about established practice of gear cutters when we cannot say the same thing about form-mills in general.

Gear cutters are made in three different styles: finishing cutters, stocking cutters and duplex cutters. Finishing cutters are form-mills pure and simple and the contour of the teeth is the shape of the gap of the finished gear wheel. At the present time there is practically only one system of gear teeth for which standard cutters are made, namely, the involute system, and the standard cutters made for this system are all made on a compromise plan. Although, strictly speaking, a gear of twenty-two teeth requires a somewhat different cutter from a gear of twenty-three teeth, the standard cutter which would be used for either of these gears would be a cutter intended for all gears from 21 up to 25 teeth. Consequently, the shape produced by these cutters is not theoretically correct. However, it is so nearly correct that it will serve for most purposes. Where great accuracy is required, a special cutter should be made for this particular number of teeth. Even this would not be entirely satisfactory. In practically all cases the pure involute shape is not used but a correction is made to overcome the interference which would result if this involute form of teeth were employed. The amount of interference depends not only on the number of teeth of the gear but also on the number of teeth of its mating gear, so that a different amount of correction would have to be made if a different mating gear were to be used. In order, then, to get the best results, special cutters if used at all should be made for a given set of mating gears.

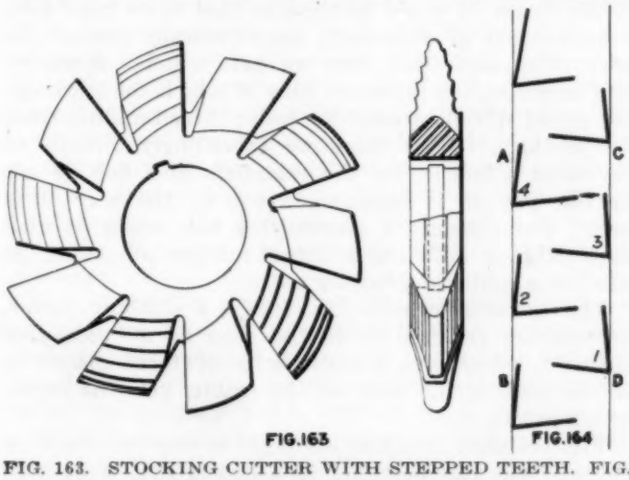


FIG. 163. STOCKING CUTTER WITH STEPPED TEETH. FIG. 164. DIAGRAM SHOWING CONSTRUCTION OF ALTERNATE-TOOTH CUTTER

Stocking cutters are made so as to cut a gap closely resembling the gap made by the finishing cutter, but leaving enough metal for a finishing cut. Whereas a standard set of finishing cutters contains eight cutters for different numbers of teeth, stocking cutters are made of a form so as to serve equally well for any number of teeth of a finished gear. As a rule stocking cutters are not used for six-pitch and finer, though for some special cases small stocking cutters might be made. If it is necessary to take more than one cut in gears with six-pitch or finer, the finishing cutter is used for stocking by reducing the depth of the cut.

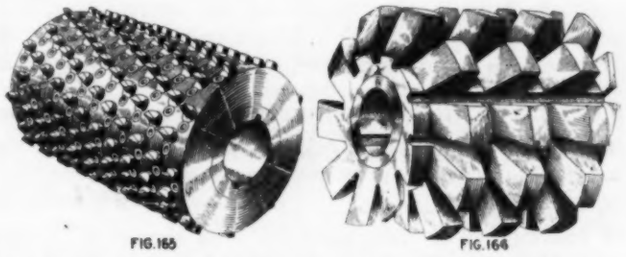


FIG. 165. "PORCUPINE" SLABBING CUTTER. FIG. 166. HOB WHICH MIGHT BE USED AS SLABBING CUTTER

One of the main objections to the cutting of gears with a disk cutter is the fact that the removal of a large amount of metal at a single point of the circumference of the gear causes local heating and corresponding distortion of the gear. Another trouble is that when some of the teeth have been cut and the cutter enters on a new cut, it has a tendency to push the tooth over into the previously made gap. For that reason it is necessary to take at least two cuts where a fair degree of accuracy is required. For heavy steel gears with coarse pitches, three cuts are taken.

If the stocking cutter were made to the same general outline as a finishing cutter, we would meet the same conditions as when cutting a deep slot with a slotting cutter. There are broad chips and a tendency of the chip to stick in the groove, causing rough surface and chatter and a corresponding short life of the cutter. For this reason, stocking cutters for the smaller pitches are made so that alternate teeth cut on the right or on

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the left side of the gap to be made. For instance, tooth No. 1 of the cutter will cut at the bottom and on the left side, whereas tooth No. 2 will cut at the bottom and on the right side, etc. In addition the teeth are stepped so as to break up the chips.

Fig. 163 shows both the stepping of the teeth and the construction of the alternate cutting edges. It has been found that when these alternate cutting edges are used with the coarser pitches, and especially on gears of large diameter, a weaving action is produced which may be so great in extent as to wipe out the amount of stock left for finish and in any case is harmful to the cutter besides producing a non-uniform result in the gear. For this reason stocking cutters for the smaller pitches are made with the alternate teeth and the step, whereas those for larger pitches are only stepped. When the system of alternate cutting teeth is employed it is often the practice to give the teeth side rake.

Fig. 164 shows in diagrammatic form how such a cutter is constructed. The lines *AB* and *CD* represent the sides

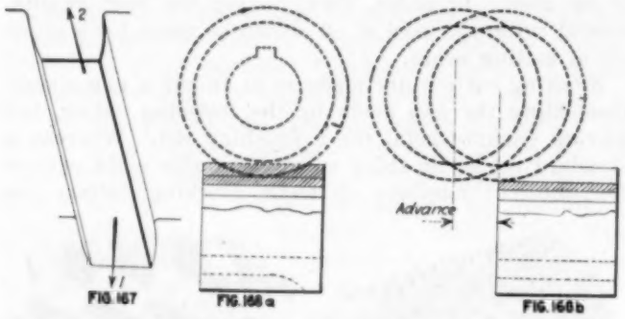


FIG. 167. TOOTH OF HOB SET PARALLEL TO FACE OF WORK. FIG. 168a. TOP VIEW OF GEAR AND HOB WITH HOB PARALLEL TO FACE OF GEAR. FIG. 168b. SIDE VIEW OF SAME

of the cut. The first tooth cuts as shown at 1, the second tooth as shown at 2, the third tooth as shown at 3, and the fourth tooth as shown at 4. This construction, though producing a smoother cutting action, accentuates the weaving of the gear under the cut and cannot be used with coarse pitches and large gears.

In order to expedite production gear cutters are sometimes made in gangs. For small gears two cutters can be set side by side; for large gears it becomes possible to use more than two cutters, and if a rack must be produced it would be possible to have as many cutters side by side as there are teeth in the rack. For the most accurate gear cutting such an arrangement is not advisable, but there are many cases where the duplex cutter produces a gear of sufficient accuracy for the purpose for which it is intended. In other cases a gang of cutters is used, arranged so that the first cutter does the stocking and the second cutter the finishing. This again is not advisable when great accuracy must be obtained because this arrangement, though providing for a roughing and finishing cut, does not take care of the local heating.

All that has been said about gear cutters can also be said about cutters intended for the cutting of sprockets, etc.

As a rule bevel gears are nowadays generated, and no other method will produce bevel gears which are even approximately correct. The generating process requires a more costly machine than the ordinary gear cutter and is somewhat slower. For this reason it is customary to stock bevel gears by means of the ordinary gear cutting process using a disk cutter as tool. To stock out a bevel gear we must use a cutter which can cut as deep as the deepest part of the bevel gear tooth, and which is as

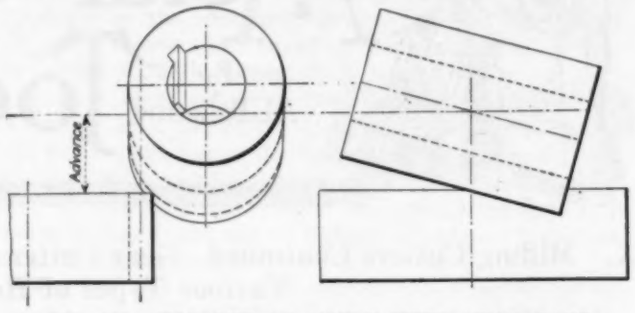


FIG. 169. HOB SET AT ANGLE WITH GEAR FACE

narrow as the narrowest part of the gap. Such cutters are made as a standard product and are very useful for the roughing operating in bevel gears. What has been said about stocking cutters for spur gears can also be said here.

There are various other form cutters which are more or less standardized, such as the cutters for cutting the grooves in twist drills, and three- and four-lipped drills, reamers and taps. Cutters for making round corners and for semi-circular grooves are also standardized.

Among the other standardized cutters, though not form cutters, may be mentioned cutters for the Woodruff key system, for T-slots, etc.

Hobs

Hobs are modified form-mills. An axial section through a form-mill would show the outline of the teeth to be made. An axial section through a hob would show a multiplicity of sections of a form-mill. If we should take a number of half round convex cutters and place them side by side on an arbor, and then take an axial section through this gang of cutters, we would get such a multiplicity as was mentioned a moment ago, and yet we would not have a hob. Most hobs, as we know them, are used for generating gears, and as the teeth in such hobs are placed spirally around the body of the cutter, it might be thought that if we have such a multiplicity of form-mills placed spirally around the body of a cutter that then we have a hob. However, this is not so, for there are hobs of which the teeth are not placed spirally around the body; thread milling hobs, for instance. It is therefore exceedingly difficult to say what a hob is, for the essentials of a hob lie not in the way it is constructed but in the way it is used. For instance a gear-cutting hob might be used as a slabbing mill, and a thread-milling hob might be used as a multiple grooving cutter.

The cutter shown in Fig. 165 is a slabbing cutter, (sometimes referred to in the shop as a "porcupine cutter"), which has a multiplicity of teeth placed in spirals around the body of the cutter, yet this cutter is not a hob.

Fig. 166 shows a hob which might be used as a slabbing cutter. The real essential of a hob is that it be used to generate some desired outline by a combined movement of cutter and work. For instance, a gear-cutting hob will generate the proper shape of the gear tooth by the following combination: the hob turns, the work turns in a certain fixed ratio to the number of revolutions of the hob and the hob advances in the direction of the axis of the gear teeth.

A thread milling hob generates a thread around the body of a screw by the following combination: the hob turns, the screw turns, (without any particular relation between the speed of revolution of hob and work), and the work advances in the direction of its axis and in a fixed relation to its speed of revolution. In both cases something is generated: in the first case, the shape of the gear tooth; in the second place, the spiral of the screw thread.

As hobs are used to generate a certain desired outline of the work, it is essential that the generating teeth of the hob shall not lose either size or shape after resharpening, and therefore the teeth of the hob must be made in the same way as the teeth of a form cutter. All that has been said about the uncertainty caused by the unavoidable inaccuracies after hardening, and, for that matter, in the manufacture of the form cutter, can also be said about the hob. In the chapter on "Cutter Sharpening" a method will be described by which some

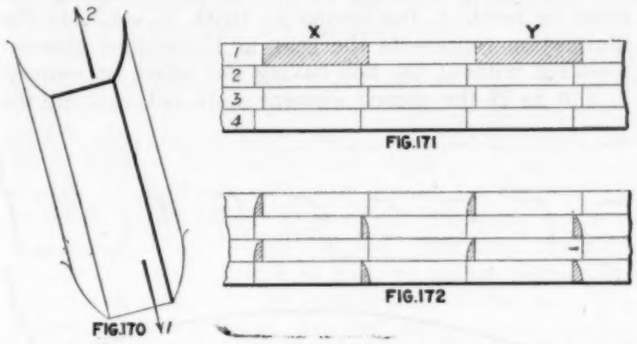


FIG. 170. TOOTH OF HOB SET AT ANGLE WITH GEAR FACE. FIG. 171. DIAGRAM OF GEAR TEETH CUT BY UNEVEN DOUBLE THREAD HOB. FIG. 172. SAME SHOWING EFFECT OF UNEVENNESS IN THE HOB

of these irregularities can be overcomee. The irregularities of which this method takes care might be called irregularities of indexing or spacing of the teeth around the body; in a hob there is another source of irregularity to be reckoned with. Not only must the teeth be spaced regularly around the circumference of the cutter but they must also be spaced regularly in an axial direction, and the method to which we refer here, though overcoming the first difficulty, does not overcome the second. In order, then, that a hob may be perfect, it is necessary to grind every surface of its cutting teeth before putting it into production. The irregularities are small and it is therefore unnecessary to use a ground hob except where accurate work is desired. For roughing or for work which requires no great accuracy, the hob can be used just as it comes from the hardening—after being properly sharpened, of course.

This is not the place to go into a treatise on gear cutting. The form of the teeth of the hob necessary to produce a good gear is a study in itself. We are concerned here with what should be done in order to make the hob cut properly and to make it retain its shape.

The first question to be answered in regard to a hob is whether the pitch of the hob should be the distance from center to center of two consecutive teeth measured in the direction of the axis or at right angles to the spiral. In other words, whether we should have axial or normal pitch. The answer depends on whether we wish to set the hob parallel with the face of the gear or not. If we do, the pitch of the hob must be measured in an axial direction. The direction of the cut will be tangential to the hob, and therefore the cutting faces of the teeth must be in an axial plane. The result of such an arrangement is that the cutting tooth of the hob has more clearance on one side than on the other.

Fig. 167 illustrates this condition in exaggerated form. A single tooth is shown in perspective. Arrow No. 1 shows the direction of the cut, and arrow No. 2 shows the direction of the spiral along which the teeth are wound around the body. It will be seen that there is much more clearance on the right side than on the left. The angle which the spiral makes with the normal plane might be so great that the clearance would be entirely wiped out, or that we might be confronted with negative clearance. As we know, one of the difficulties in a form cutter is to produce enough side clearance, and this arrangement, reducing the side clearance on one side of the teeth, makes the difficulty that much greater. A hob constructed in this way is easily set and requires less advance and consequently less time for a gear of given face. On the other hand, its cutting qualities are not so good as those of the other types.

Fig. 168a shows a top view of a gear and hob, the latter being set parallel to the face of the gear. Fig. 168b shows a side view indicating the advance; that is, the distance the hob must travel before it cuts to the full depth. Taking as example a gear of 2-pitch and a 5-in. diameter hob, the depth of cut would be 1.078 in. and the distance the hob would have to travel before it is in to the required depth would be 2.056 in.

Fig. 169 shows the hob set at an angle with the face of the gear. In the position shown, some point of the hob touches some point of the gear blank. The exact location of that point depends on the diameter of the blank and the angle to which the hob is set, but it is plain that it will be some time before a point of section *AB* touches the work. In other words, the amount of advance is greater.

In this type, the teeth are arranged as shown in Fig. 170 where a single tooth is again shown. Here, too, arrows No. 1 and No. 2 represent the direction of cutting and of spiral respectively; but in this case these two arrows have the same direction, and consequently the clearance is the same on both sides of the tooth and is therefore as favorable as it can be made under the circumstances.

When using a hob it is necessary to have its axis make an angle with the face of the gear equal to the angle of the spiral figured on the pitch line. If such a hob is used for the cutting of spiral gears, the angle of the hob with the face of the gear must be equal to the sum of the angles of the spirals of gear and hob, or their difference, depending on the direction of spirals.

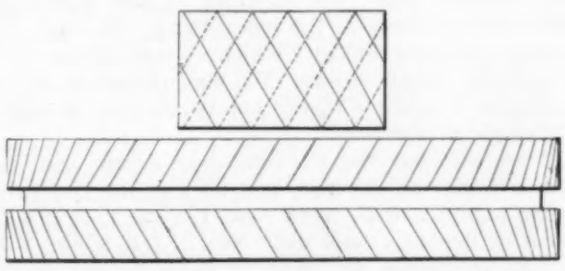


FIG. 173. HERRINGBONE GEAR CUT BY PARALLEL HOB

In order to expedite cutting, hobs are often made with multiple threads. If a single-thread hob is used, and the gear to be cut has sixty teeth, then sixty revolutions of

the hob are required for one revolution of the gear. If the feed of the hob downward is 0.060 in. per revolution of the gear, each revolution of the hob finishes the gear

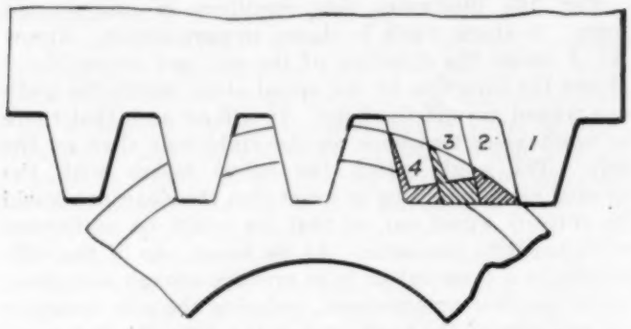


FIG. 174. AXIAL SECTION OF HOB AND 60-TOOTH GEAR BLANK

to a depth of 0.001 in. If a double thread hob were used, thirty revolutions of the hob would correspond to one revolution of the gear, and 0.002 in. of the gear would have been finished by one revolution of the hob. This shows plainly how the multiple thread hob is preferable if rapid production is the object. In that sense, it will be still more desirable to have triple or quadruple thread hobs and, as a matter of fact, such hobs are often used.

One of the reasons why a hob, generally speaking, produces a better gear than the disk cutter, is the fact that we are more or less independent of the accuracy of indexing. The index movement is continuous which makes us entirely independent of much delicate mechanism which must be employed when the indexing is intermittent. We are dependent on the accuracy of the hob, and it is possible, by proper methods, to make hobs which possess this quality to a high degree.

In constructing the hob we use methods of thread cutting combined with backing off, and when high-grade hobs are made, they are ground after hardening, again employing the same general methods as used in thread cutting and backing off. These methods lend themselves to a very high degree of accuracy, provided that the hob has a single thread only. When, however, we construct a double thread hob or in general a multiple thread hob, we must interrupt the operation of thread cutting when we have finished a single thread, after which we must index the hob to a new position suitable for the commencement of the second thread, and we must then set our tools or grinding wheel, or whatever we use, to exactly the same finishing position which they had at the end of the first thread, so that we introduce two new elements here: the accuracy of the indexing as well as the accuracy of the tool setting. In other words we meet the same difficulty which we meet in the cutting of multiple thread screws. We may therefore say that, in general, a multiple thread hob is not quite so accurate as a single thread hob.

If we consider the 60-tooth gear again, and cut it with a double thread hob, and we call the two threads of the hob *A* and *B*, teeth Nos. 1, 3, 5, 7, etc., will all be cut by thread *A*; and teeth Nos. 2, 4, 6, 8, etc., will all be cut by thread *B*. And if there is any error in accuracy between threads *A* and *B*, either in spacing or in size of the teeth, their depth, or the like, this error will be reproduced in the gear, and teeth Nos. 1, 3, 5, 7 will be different from teeth Nos. 2, 4, 6, 8. If the gear had 61 teeth we would have a somewhat different condition. The first time the gear goes around, thread *A* of the hob will generate a small portion of teeth 1, 3, 5, 7 . . . 57, 59, 61, and thread *B* will generate a small portion of teeth 2, 4, 6, 8, . . . 56, 58, 60. But when the gear goes around the second time, thread *A* will generate the next element of teeth 2, 4, 6, 8, . . . 56, 58, 60, and tooth *B* an element of teeth 1, 3, 5, 7, . . . 57, 59, 61. This shows that the error between teeth *A* and *B* is not bodily duplicated in the gear. The first element of tooth No. 1 might be a little bit too far to the right, but the second element, being generated by tooth *B*, would be proper; and furthermore, the nature of the way in which the hob tooth approaches the work would make it remove most of the excess metal left by tooth *A*. The total result in such a case might be that the width of all the tooth gaps would be slightly too great.

Fig. 171 shows a front view of a portion of a gear, two gaps being shown, *X* and *Y*. The first element is made by tooth *A*, the second by tooth *B*, etc., and the illustration represents the gear as if the first element were cut without the hob having any effect on element 2, and as if the second element were cut without the

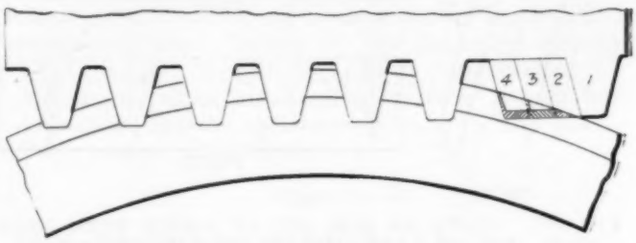


FIG. 175. AXIAL SECTION OF HOB AND 15-TOOTH GEAR BLANK

hob having any effect on elements 1 and 3. Fig. 172 shows the same thing, this time indicating how the hob does have an effect on other elements besides the one it is generating, and it shows very plainly how the final effect must be a wider tooth gap than desired. This error of a somewhat wider tooth gap is, as a rule, not highly objectionable, so that we find that it is possible to cut a fairly accurate gear of 61 teeth with a double thread hob; but it would not be possible to cut an accurate gear of 60 teeth with that same hob.

In general we may say that errors of the hob are reproduced in the gear when the number of threads in the hob is a divisor of the number of teeth of the gear. It would not be possible, then, to produce a very accurate gear of 60 teeth with a hob with two, three, four, five or six threads; but it would be possible to produce such a gear with a hob with a single thread or with seven threads. It should be understood that the errors mentioned are very small in a well-made hob, but that, however small this error may be, there is an additional source of error contained in the fact that we use a hob with multiple threads.

As it is possible to make a single thread hob so that the pitch of the gear is the same as the pitch of the hob measured in an axial direction, or in the direction at right angles to the spiral, so it is possible to make a hob so that the pitch of the gear corresponds to the pitch of the hob measured in some other direction—in any arbitrary direction, in fact. Doing this it becomes possible to construct a hob with parallel gashes, but which must be set at an angle in order to produce the correct pitch. In that way the difficulty mentioned before,

namely, the lack of clearance on one side of the hob teeth, can be largely overcome. It might be asked what advantage is left in regard to the use of hobs with parallel gashes if we set them at an angle with the face of the gear. The answer would be that it is much easier to resharpen a hob with parallel than with spiral gashes.

This method is often followed when constructing hobs for spiral gears, and especially for herringbone gears. As a rule, it is advisable to have the two parts of a herringbone gear as close together as possible. If such a herringbone gear is generated in a shaper, the only space between the two parts of the gear required for the run out of the tool will be ⅛ to ¼ in.; so that the method of shaping a herringbone gear is very attractive if nothing else must be considered except the space between the two parts. However, the shaping method, developing local heat, is much more apt to produce an incorrect gear than the hobbing method, provided that all other conditions such as accuracy of machine and care in the operation are the same.

Where herringbone gears are employed it is generally desirable to have them running very quietly; in fact it may be said that this is the chief reason for the use of spiral and herringbone gears. Naturally, then, one would want to use that method which gives the highest degree of accuracy and this would be the hobbing method. If we should have to cut a herringbone gear with a spiral angle of 45 deg., we would have to set the hob to that angle, more or less; so that a part of the hob would run into the second part of the gear long before we had finished the first part, unless the gap between the two parts was made very wide. It is therefore desirable in such cases to find a way which makes it unnecessary to set the hob to the angle of the spiral.

Fig. 173 represents a herringbone gear and a hob set parallel with it. The teeth which will come in contact with the gear, the cutting teeth, are back of the hob and are shown in dotted lines. These teeth must be in the direction of the teeth of the gear, so that the teeth in front of the hob will appear as shown by the full lines. The spiral along which the teeth of the hob are wound around the body will have a very large lead, and it will therefore be necessary to make the hob with multiple threads in order to get that lead.

In such a case it becomes necessary not only to select the proper number of threads to give the correct lead, but also to select a diameter of hob on which this lead will produce the desired angle. If, for instance, we should wish to cut a spiral gear with a normal pitch of 1 in., and a spiral angle of 45 deg., we would have to make the spiral of the hob threads also 45 deg. If we should find that the smallest hob which can be put in the machine is 2½ in. in diameter on the pitch line, then the circumference on that pitch line would be 7.854 in., which means that the lead would also be 7.854 in. if we wish to have a 45-deg. angle. The normal pitch of the spiral gear being 1 in., its circumferential pitch will be 1.4142 in.; so that we would have to make five threads in order to come somewhat near the desired lead of 7.854 in. This lead, however, would be only 7.071 in., which is not enough. We must, therefore, give the hob six threads, which brings the lead up to 8.4852 in., and this again means that the circumference of the pitch line of the hob must be that amount—8.4852 in. In order to have this circumference, we should have made the hob 2.670 in., and not 2½ in. in diameter.

A hob constructed in such a way will produce any spiral gear of 1 in. pitch normal, and 45. deg. spiral angle, but will not be useful for a gear of any other pitch or spiral angle. As far as the pitch is concerned the hob does not suffer in comparison with other hobs because one hob is good only for one pitch, but when the hob is so constructed that it must be set to the spiral angle plus or minus the angle of the thread of the hob, then such a hob is good for any gear of that pitch and the gear may be either a spur or spiral gear of any angle.

In ordinary milling practice we know exactly the amount of metal to be removed on a given piece of work. If the piece is a rough casting or forging the amount may vary as we feed along, but whatever this amount may be it is the same for all the teeth of the cutter, and this is true for a form mill as well as for a spiral mill or end mill. This uniform condition does not exist when we use a hob. Each tooth of the hob removes a different amount of metal if it comes into action at all. If we should cut a hob in two in an axial plane we would find that the outline of the section is the same as a rack. The action of the hob on the gear is the same as if this rack moved up and down like a slotting tool and while moving up and down moved also endwise, keeping in mesh with the gear just as if gear and rack were meshed together. As a matter of fact there is no such endwise movement, but the location of successive teeth in a spiral around the body has the same effect as if the cutter were moving endwise. If there are twelve teeth in one convolution, each tooth will be ⅓ of the pitch further toward the right or left (according to whether the spiral is right or left handed), and when the hob has made one complete turn twelve cuts have been taken, each one ⅓ of the pitch further to the right or left.

Fig. 174 shows an axial section of a hob, operating on a gear blank. The action of only one of the convolutions, the end one, is shown. The hob is supposed to have only three teeth per revolution. Position No. 1 shows a tooth just touching the work. After one complete revolution position No. 4 is reached by some tooth, the first tooth of the next convolution. The shaded portions show the chip taken by the different teeth, Nos. 2, 3 and 4. As a matter of fact the shape of these chips would be slightly different, due to the fact that the wheel is meanwhile rotating, but this detail has been left out of consideration in order to bring out the main point, namely, that each tooth removes a different amount of metal. As a result the different teeth will wear to a different degree. There will be some teeth which have merely scraped the work, others which have taken heavy amounts of metal, and consequently the life of the hob depends on the size of chip taken by that tooth which does the heaviest work.

Not only does the amount of metal removed per tooth depend on the pitch of the gear and the number of teeth per convolution, but it also depends on the size of the gear. Fig. 174 represents a gear with sixty teeth, while Fig. 175 represents one with fifteen teeth. It will be seen that the hob is much longer in action on the large than on the small gear, and consequently that the full amount of the gap between the two teeth must be removed in a very much shorter time on a small than on a large gear. The illustration shows plainly that the chips removed in positions Nos. 1, 2, 3 and 4 are not at all of the same section in the two gears. As more teeth come into action on a large gear we may expect

the life of a hob to be greater when cutting larger gears.

There is still another point which affects the life of the hob. In order to illustrate this we will consider a hob used for generating spline shafts. Spline shafts as used in automobiles are made with 4, 6, 8, or 10 teeth or splines. In order to bring out the peculiar action of a hob when cutting a spline shaft with a small number of splines, we will assume a small hob and a large shaft: say a hob 2½ in. in diameter and a shaft with a diameter of 5 in. We will further assume that the depth of the spline is ¼ in. Under such conditions a tooth of the hob will work in the spline along an arc of which half the chord is ¾ in., which is an arc of approximately 37 deg. The hob makes four revolutions for one revolution of the shaft, so that, during the time the hob has traveled through an arc of 37 deg., the spline has traveled through an arc of 9¼ deg. In other words, any point of the spline shaft has traveled through a circular distance of 0.800 in. We see, then, that while the tooth of the hob is going through the work a distance of approximately 0.75 in., the work moves sideways against the tooth of the hob a distance of 0.800 in. This shows the necessity of having ample clearance on the sides of the teeth of the hob. The failure to provide sufficient clearance is one of the chief sources of failure of the hobbing process.

In order to reduce as much as possible the size of the heaviest chip taken by a hob tooth it would be necessary to have as many teeth in the hob as possible. However, the teeth must be strong enough and must have metal enough to stand a number of grindings, so that the only way we could make a hob with a large number of teeth would be to make it of large diameter. But when we do so we limit production. If, for instance, we should have a gear of 60 teeth and a hob 4 in. in diameter, and we find that we can run at a cutting speed of 100 ft. per minute, then we would make 100 revolutions per minute, approximately. If we further find that a feed of 0.060 in. per revolution of the gear is the best we can do with the desired finish, we will finish 0.060 in. of the face of the gear in 60 revolutions, or in 36 seconds. If now we should make the hob twice as large, 8 in. in diameter, in order to get more teeth, we would be able to run the hob only thirty revolutions per minute and it would now take 72 seconds to finish 0.060 in. of the face of the gear. Here again is a case for compromise.

There is often doubt on the part of the shopman as to whether he should use a ground hob or not. The methods employed in making ground hobs are of a high degree of accuracy and as a result the accuracy of the gear produced will be much greater. Besides, the fact that the roughness caused by hardening has been removed, makes the hob better considered as a cutter. The same advantage which is found to exist in a cutter of which the teeth were ground on all sides will be found in the teeth of a ground hob, in other words, a ground hob will have a somewhat longer life between sharpenings. However, some hobs are ground in such a way that it is not possible to give as much clearance as on unground hob, and in that case all the advantages of the ground hob as to long life disappear. It is well, therefore, to examine a ground hob as to the amount of clearance given by the grinding. Due to the great difference in price of ground and unground hobs it may be advisable to use unground hobs for roughing and even for finishing where extreme accuracy is not required.

Where Some Sales Systems Are Weak

By S. Owen Livingston
President, Grand Rapids Grinding Machine Co.

In times like these it would seem as if it behooved every manufacturer to give the most efficient service on all inquiries, yet many of them are subjecting their prospective customers to a serious and I believe needless annoyance.

My point can be illustrated by a couple of instances that have occurred within the last couple of weeks. A mechanical device made in Chicago seemed to be of interest to my firm. A letter of inquiry was addressed to the Chicago office and we patiently waited for a reply. It was delayed to such an extent that we were about to send a second inquiry, feeling that the first one had been lost, when we received a reply from Cleveland, Ohio, from which office apparently the state of Michigan was covered.

In another case we were considering the use of a certain part which we had reason to believe could be best purchased from a manufacturer in Cleveland. We wrote asking for information, explaining it was wanted as a basis for tentative design. Just one week later we received a reply from the Cleveland office saying that our inquiry had been referred to their Detroit representative and not giving us any of the information we asked for.

We believe that these instances are more or less typical of many. Of course we realize that any manufacturer must work with his branch houses and sales agencies, but we do not believe that the co-operation with these would be in any way handicapped by giving the information direct from headquarters promptly and supplying such branch office or sales agency with a carbon copy of the letter giving the information. Certainly headquarters should be in a position to give as accurate and complete information as can be given by a branch unless the branch is in a position to make an immediate personal call. The prompt reply would have been of distinct advantage to us in both cases referred to and the delay has caused an antagonistic feeling that it will take mighty good salesmanship to remove.

I know of one case, not a personal one however, where a manufacturer of sensitive drill presses referred an inquiry to a sales agency in a branch house, but failed to send the inquirer the information regarding prices, specifications, delivery, etc., which had been requested. The dealer to whom the inquiry was sent seemed to prefer to sell some other make, with the result that the customer was almost forced to buy a make that he was not partial to. If the manufacturer had sent the full information regarding prices, delivery, and machinery specifications to the prospect and sent a carbon copy to his sales agency, the manufacturer would have received an order for the machine and the customer would have been better satisfied. Of course the sales agent in this case was inexcusable and subject to just censure but the blame can be directly charged to the manufacturer who was so short sighted as to fail to protect his own interest and the interest of his prospective customer, through the mistaken idea that he was more fully protecting the interest of his sales agent.

My plea is that every inquiry which a manufacturer receives should be immediately answered with the most complete information possible or with a courteous explanation of the reason why the information is not forthcoming.

The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

WHETHER the foreman is directly responsible for the training of workers or not, the man who wants to succeed should be somewhat familiar at least with the methods used in various plants. None are perfect, none will apply to all plants as conditions vary greatly. But from them all we can gain a little which may help in our own problems.

We must consider first what we wish to teach. Is it simply to train a man or woman to perform one operation—to drill one size hole in one piece—or do we wish to have them handle several operations on the same piece?

According to some theories the greatest efficiency is secured by sub-dividing the work into minute operations, to have each operator become so familiar with the work that it becomes second nature and requires no thought. There is a growing belief, however, that this is more theoretical than practical as it ignores the human side and considers men and women as attachments to machines rather than as individuals. Careful experiments show that production depends upon more than experience and skill, that the attitude of mind has much to do with it as well.

When an operator tackles a new job the production is necessarily low until he or she becomes familiar with the work. Then the production curve rises until it reaches a maximum, which will of course vary with different conditions such as hard castings, trouble with machines and other factors. This average will continue as long as the operator is interested in the work or what it brings.

Teaching Several Operations

The time usually comes, however, when the monotony of doing the same minor operation, day after day and month after month, affects production and the rate begins to fall. Recognizing this, some shrewd managers are advocating teaching the worker how to do several operations instead of one. Then, before the production falls, the worker is transferred to another operation which renews the interest. Of course this does not secure maximum production at all times, but the average should be higher and we are more apt to have a contented lot of workers than with the other system.

This also has another advantage in providing a more flexible working force. For should the workers of any department be subject to an epidemic, or should a given department fall behind in its production, we can recruit its working force from other departments and so maintain a balanced production. The greatest value, however, is almost sure to come from the affect on the mind of the workers. The looking forward to a change of work can hardly fail to help prevent monotony and to renew and maintain the worker's interest in the plant. And the changes should be made as often as it may prove desirable, always keeping an eye on the maximum of production and the minimum of grouches and discontent.

Changing to Another Job

The length of time between changes must not be a hard and fast rule figured out by formula and a calculating machine. It must depend upon the kind of

This Was Good Enough for Grandfather

work, the kind of people employed and the physical conditions of the plant and its surroundings. Phlegmatic people, plodders as we call them, do not require frequent changes and, in fact, might even resent them. In such cases we may be tempted to forget all about shifting them at all.

But we must remember that the temperament which opposes change or progress in the shop, will also oppose progress in town or city government. And unless we wish to stand against progress of all kinds we must not forget that we owe a duty to the country in doing something toward instilling progressive ideas in the minds of the men and women in our shops. The policy of "letting well enough alone" would have kept us in the cave and our mode of transportation would have been the ox cart and the dug-out, instead of the airplane and the ocean steamship.

One of the best examples of the desirability, if not the necessity, of changing men from one job to another —and having this change depend on the man and the conditions of the work, happened in a foundry. The man, a foreigner of only average intelligence and temperament, ran the rattler or rumbler that shakes and

pounds the sand from the castings. It is a noisy job and a dirty one, but it is a necessary part of the foundry output.

One day the rattler broke down under suspicious cir-

MIKE'S SAFETY VALVE

cumstances. The gears which drove it suddenly went to pieces and there seemed to be good evidence that someone had deliberately dropped a casting into the gears. The operator had held this job a long time and he stoutly denied smashing the gears. Finally the manager took a hand and called Mike into the office. Without any preliminaries he said: "Mike, what made you smash those gears?"

With only a second's hesitation Mike replied "Because I couldn't stand that d—— noise any longer."

The manager was human—he had vision and imagination—and he saw the light. A little questioning showed that Mike had sickness at home, had lost much sleep on account of it and his nerves were raw and on edge. He had been on this job seven years.

"Mike you've been on that job too steady. You're a good man and we need you there. But you're going to have a change. You go home now and rest up a few days. Come back Monday and we'll forget all about the smash up. We'll give you some quiet work next week, then you can take the rattler again—and change every week. It's too noisy for a steady job. The next time you feel like smashing the gears—don't—come and see me instead."

This is only a small incident and with only what we call a "common laborer." But the effect of such broad-minded management spread through the whole shop and was more far reaching then we can tell. It is acts like this that make for loyalty and co-operation all down the line.

Abstract from the Annual Report of the Committee on Industrial Education of the N. M. T. A.

During the past year the work of the Committee on Industrial Education of the National Metal Trades Association has been one of progress. Inquiries from interested members have been numerous and have come from every section covered by the association. When the request has been for personal service, it has not always been possible to comply, as with only a single representative in the field it has been necessary to work systematically by districts, but, of course, such temporary assistance as could be rendered by correspondence has been furnished.

As a result of its studies during the year, the committee finds the following conditions to exist:

(1) There is a shortage of efficient workers for normal production.

(2) Too few companies train workers.

(3) Many of those who do attempt to train workers have nothing even approximating a definite schedule for this work, and have not definitely determined the responsibility for instruction and training as part of the duties of some person or group.

(4) Very few foremen are able to give proper instructions in the necessary training.

(5) Conditions within the various plants determine the type of training necessary.

In view of these findings, the committee has two specific recommendations to offer, namely:

(1) That a definite number of specialists or apprentices be trained in each shop; this number to be proportionate to the total number employed.

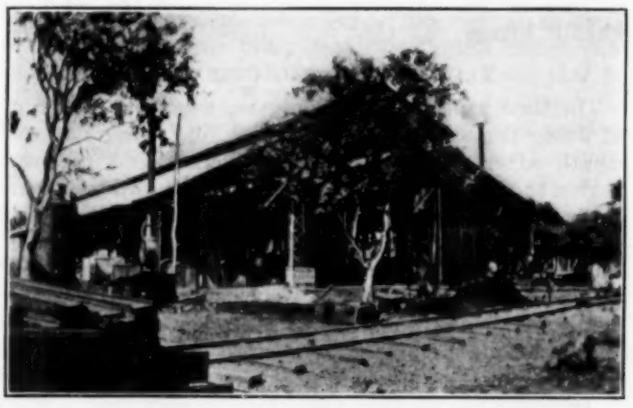
(2) That a committee on industrial education and training be formed in each branch, such committees to co-operate with local educational or training institutions on questions pertaining to technical, vocational, part-time and continuation schools and to consider ways and means of furthering training and education within the plants of our members. The committee is of the unanimous opinion that training in industry is vital, and that every member should do something in this respect.

It is the belief of the committee that in a majority of instances, shops with one hundred or more employees should consider seriously the establishing of a training department. In the smaller shops the quota could be trained in connection with the toolroom or some special department. Each plant should have some individual in charge of and responsible for the training.

The Only Bolt Works in India

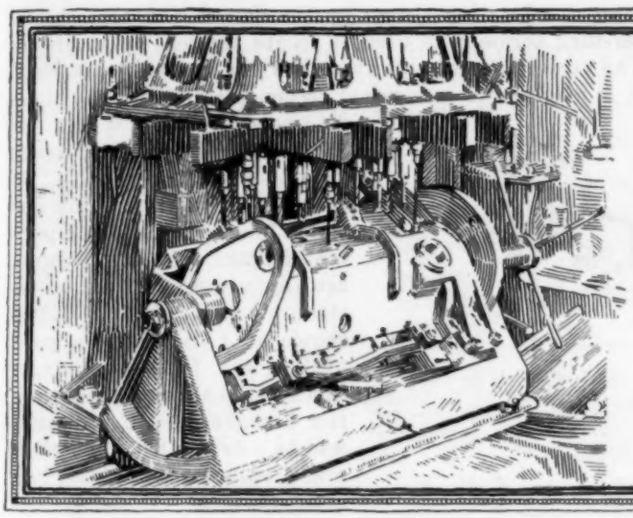
The illustration shows the sole manufacturing plant devoted to the making of bolts in all India, the Bengal Bridge and Bolt Co., Ltd. The source of power consists of two traction engines. They are connected to the lineshaft by belts over the flywheels.

As can be seen from the photograph the shop is noth-



THE ONLY BOLT WORKS IN INDIA

ing more than a shed with a dirt floor. We are indebted for the snapshot to Mr. Meyer of the Landis Machine Co., who is now in the Orient.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Drill Jig Design Continued—V-Block Design—Leaf Jig Design—Leaf Construction—Clamps in the Leaf—Leaf Stops—Leaf Locks

MANY types of V-blocks for locating and clamping are found, several of which are shown in Fig. 45. The type shown at *A* is found in every toolroom and is used for various jobs on the milling or drilling machine. Clamping action in setting up a piece of work, such as shown at *B*, should be in the direction indicated by the arrow. It is not, however, necessary to have the pressure of clamping through the center of the V-block as it may be a trifle to one side or the other without causing any inaccuracy in the work. Another type of V-block, shown at *C*, is very useful in jig work. The angle is slightly less than a right angle and as a consequence pressure applied in any direction indicated by the arrows will force the work *D* directly into the block. This type is commonly used for small work.

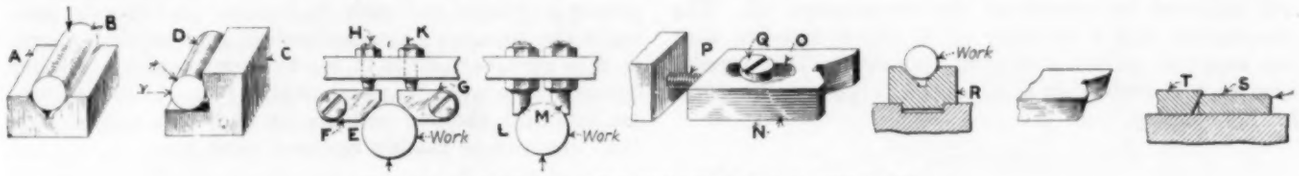


FIG. 45. V-BLOCKS, STATIONARY AND ADJUSTABLE

An adjustable V-block is shown at *E*. The blocks *F* and *G* are pivoted on the studs indicated and may be adjusted by means of the headless screws *H* and *K*. After the adjustment the check nuts must be tightened to make the location permanent.

Still another type of adjustable V-block, shown at *L*, will need some round pins cut at an angle at the point *M*. This type of *V* can be adjusted by means of the check nuts. The objection to this type, and also to that shown at *E*, is that there is always a possibility of the nuts loosening so as to cause variation in the location.

The principle of a sliding V-block is shown at *N*. The block has a slot at *O* which permits adjustment. Pressure can be applied through the screw *P* to adjust the block. An arrangement of this kind is not good on account of the opening at the slot which allows chips to accumulate, causing considerable trouble. Furthermore, practically all of the pressure applied by the angular jaws is taken on the head of the screw *Q*. If it becomes necessary at any time to use a block of this type it should be tongued as shown at *R* and a suitable sheet metal cover should be placed over the slot to protect it from chips and dirt. When a V-block is made like that shown at *R* there is always a possibility of chips accumulating under the sliding portion so that after a while it can be operated only with difficulty. For locating several V-blocks in line with each other when they are not adjustable they may be tongued as shown. Occasionally a piece of work is located in a V-block and it is at the same time desirable to hold the work down by means of the V-block. An example is shown at *S*, where the work is located by means of the sliding V-block *T*. The block may be undercut to an angle of about 10 or 15 deg., so that it will not only locate the work but will hold it down as well.

At *B* in Fig. 46 is shown an approved method of locating sliding V-blocks. The block is fitted on the sides to the slot at *C* and is held down by means of gibs at *D*. The block is operated by means of a screw at *E*. This is the best method of making a sliding V-block, but it is sometimes desirable to make the gib *D* in the form of a flat plate extending completely across the V-block. Naturally these points may be varied to suit and do not affect the fundamental features of design. Another type of block is shown at *F*. There may be cases when a block of this kind has advantages but in general it is expensive to make and has no practical advantage over the design shown at *B*. The plate *G* is expensive and difficult to fit.

The method of fitting a slide as shown at *H* is not to be commended as it is much more difficult and expensive than the design shown at *B*. We have seen V-blocks made in this way but have not approved of the design. It is usually considered good practice to keep a design as simple as possible so as to avoid unnecessary machining and fitting.

In Fig. 47 is shown at *A* a type of swinging V-block

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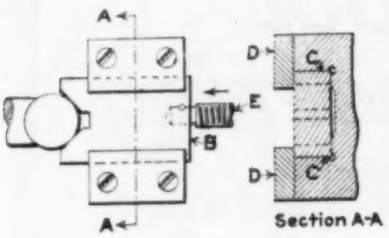
which is quite useful on small work. Blocks of this kind are useful where the work is located by a central stud on the jig. The work shown would be difficult to locate in a regular sliding V-block. Blocks of this kind can be made up in quantities for small work and to a certain extent standardized so that they can be used by simply drilling and tapping a hole for the screw shown at *B* and applying the block *C* which carries the backing-up screw.



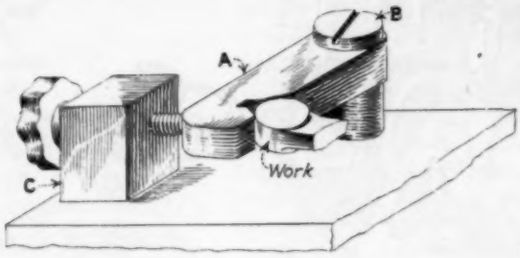


FIG. 46

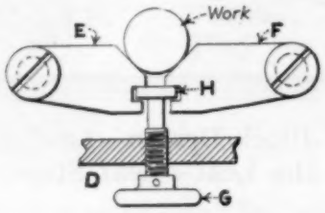


FIG. 47

FIG. 46. SLIDING V-BLOCK DESIGN. FIG. 47. SWINGING V-BLOCK DESIGN

Another type of swinging V-block is shown at *D*. The V-block is made in two parts, *E* and *F*, controlled and adjusted by means of the thumbscrew *G*. The thumbscrew has a shoulder at *H* which engages with two supports on the swinging members. This type is used to a considerable extent by a large manufacturer in this country.

Leaf Jigs

In the design of leaf jigs there are many points to be considered. In the example shown in Fig. 48 the jig *A* was designed for holding the work *B*, while being drilled through the portions indicated at *C*. The work is fastened into the jig in one position, after which the jig is turned over until it assumes the position shown, in which position the drilling is done. There is no particular objection to this type of jig and it is in common use in many factories. However, a leaf jig design is shown at *D* for comparison. The leaf *E* is swung back against the leaf stop indicated while the work *B* is being loaded on to the stud. The leaf is then swung down into position carrying the work with it until it takes the location shown by the dotted lines. A quarter-turn screw *F* is used to locate the leaf in position. The advantages of this type over the one at *A* are that it is much more convenient to operate and if a multiple drill-head is used, it can be clamped firmly to the correct location on the table.

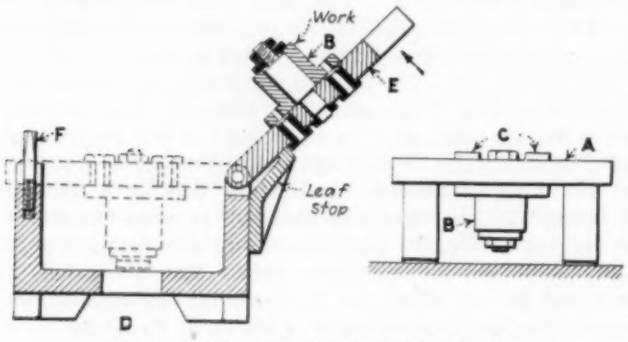


FIG. 48. LEAF JIG OF SIMPLE DESIGN

In the construction of jig leaves the hinge is an important factor. Several methods are in vogue. There is a straight pin such as that shown at *A* in the upper part of Fig. 49. In this construction it is considered good practice to make the pin so that it will be a drive fit in the leaf *B* and a running fit on the two end bearings. Probably the best construction obtained is by making the pin a standard taper like that shown at *C*. When this construction is used the adjustment for wear can be made very easily and any amount of freedom can be made in the leaf by simply giving an additional turn to the taper reamer.

It is sometimes desirable to make a leaf like that shown at *D* in order to obtain a slightly equalized action on the leaf when it is used for clamping or for some other purpose. In the construction of jigs which are to be used for thousands of pieces, it is advisable to make proper provision for wear in the leaf in order to preserve the accuracy. A construction such as that shown at E is excellent and is in use by a number of manufacturers. The wear plates shown at *F* are hardened and set into both the leaf and the jig body. It will be seen that they can be readily replaced when worn.

Clamps in the Leaf

In connection with leaf construction we must also consider the instances when clamping action is applied through the leaf. There is an important point which should always be thought of when clamps are to be inserted in a jig leaf, and that is that the leaf must be made heavy enough so that it will not buckle when the pressure is applied. In Fig. 50 several types of clamps which can be applied to the leaf of a jig are shown. The leaf *A* should be made heavy enough to take the pressure of the screw *B* so that it will not tend to buckle and take the position indicated by the dotted lines, as this would make the bushing *C* out of alignment with the work. Attention should also be paid to the position of the screw *B* in relation to the bushing *C*. The amount of space required at *D* will be dependent upon the general condition and size of the jig.

Another method of clamping through the leaf of a jig is shown at *E*. Pressure is applied through the clamp *F* by means of the screw *G* so that the ball-portion *H* comes in contact with the work as indicated. One end of the clamp is rounded at *K* where it bears against the leaf. It is prevented from falling out of the leaf by the pin lever *L* and the guard pin *M*. This construction was used in order to allow free use of the bushing *N*, and at the same time clamp very close to it. It is evident that a hole in the clamp is necessary as indicated.

A very useful type of leaf clamp for small work is indicated at *O*. It is a type that is used preferably on finished work because its action is limited. The movement of the pin *O* is controlled by the screw *P* acting

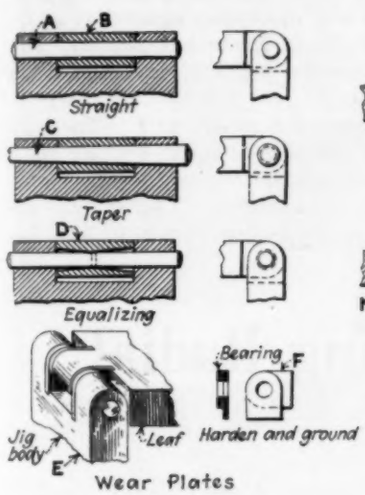


FIG. 49

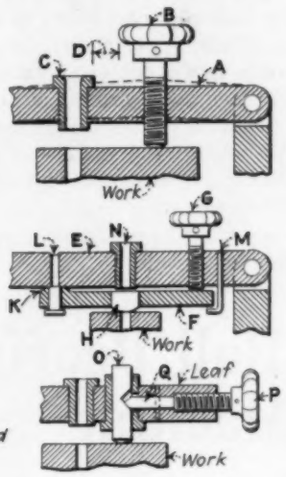


FIG. 50

FIG. 49. JIG LEAF CONSTRUCTION. FIG. 50. CLAMPS IN JIG LEAVES

on the angular cut in the pin through the plug *Q*, also cut to an angle on the end which engages with the cut in the pin.

There are some cases where the clamp is used in a leaf when the leaf does not carry any bushings. Referring to Fig. 51, the sketch at *A* shows a leaf of this sort having a rocking clamp *B* pivoted on the leaf. There are no bushings on the leaf and it is used principally for clamping. The clamp pressure is applied through the eye-bolt and hand knob *C* and *D*. The end of the leaf must be supported so that the bolt can be swung out of place in order to lift the leaf. This form of construction is very common and will be found useful in many cases.

When a leaf contains several bushings as at *E* the form of construction shown is commonly used. The end of the leaf is so supported that the quarter-turn screw *F* passes through it when the leaf is lifted. When it is locked in position the head of the thumbscrew binds it firmly in place.

In Fig. 52 several kinds of leaves are shown. Two methods of making a hinge are indicated at *A* and *B*. In the case *A* the hinge swings at *A* and therefore has a short bearing, while in the other case the hinge

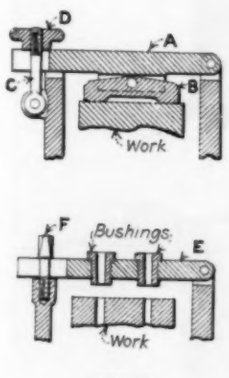


FIG. 51

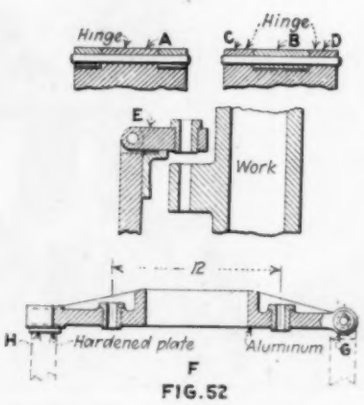


FIG. 52

FIG. 51. LEAF CONSTRUCTION. FIG. 52. LEAF CONSTRUCTION

hangs from the points *C* and *D*, which are much further apart so that greater accuracy is assured.

A leaf like that shown at *E* is sometimes useful in jig construction when it is necessary to place a bushing close to the work and at the same time get it out of the way while the work is being removed. It is a good idea to provide some means of clamping the leaf while drilling. A quarter-turn screw or some other approved method can be used.

It is often necessary to lighten a large jig in order to expedite the handling of it. Sometimes it is advisable to make a leaf out of aluminum as shown at *F*. It is a good idea to provide bushings at the hinge point *G* and hardened plates at the end *H* in order to avoid having the wear on the soft metal.

Leaf Locking

Jig leaves may be locked in a variety of ways, several of which are shown in Fig. 53. The leaf *A* is fastened by means of a quarter-turn screw *B*, the end of the leaf being supported. Wear plates at the bearing points should be provided if the jig is to be used for a great number of pieces. Sketch *C* shows provision to simplify

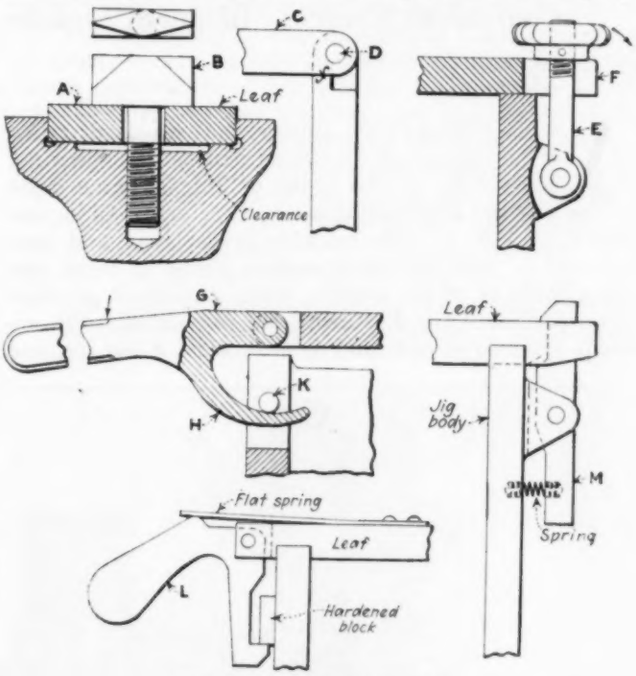


FIG. 53. LEAF LOCKING

the toolmaker's work in putting on the pin *D* by leaving the finished support *f* from which to locate the jig leaf while drilling the pin hole. This support can be machined when planing up the jig. An eye-bolt lock having a jig leaf is shown at *E*. When such a lock is used the end of the leaf should be rounded off at *F* in order to facilitate the opening. The cam lever fastening shown at *G* can be used to advantage in many cases for fastening the leaf in position.

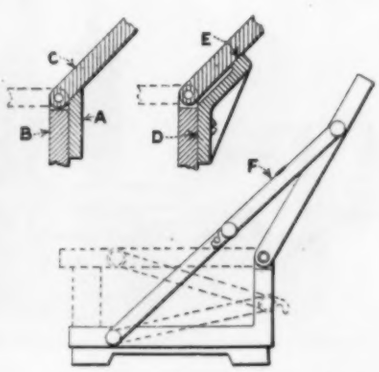


FIG. 54. LEAF SUPPORTS

Care must be taken to make sure that the radius *H* is not too small to prevent the proper locking on the pin *K*. As a general thing tool designing departments have a set of standard cam levers which give the important dimensions. Two other types of leaf lock levers are shown at *L* and *M*. Speaking generally the writers do not favor these forms of construction. It must be admitted, however, that they are in use in a number of factories with more or less success. The principle objection to their use is the fact that there is very little adjustment for wear and they are therefore likely to become inaccurate after they have been used a short time.

When a jig is being used it is important to provide a rest for the leaf when it is thrown back in loading or unloading the jig. If some provision is not made there is a chance that the operator may throw the leaf over and break or strain it. Several types of leaf stops are shown in Fig. 54. The one indicated at *A* is a simple type which is fastened to the wall of the jig *B* so that the leaf, when swung up, comes against it at *C*. Another type, shown at *D*, is somewhat similar, but very much better, because the point of leverage *E* is farther away from the hinge.

Another type of leaf support is shown at *F*. The leaf is held up by means of an arrangement similar to a trunk lid support. This construction is incorrect and possesses no particular advantages. There may be cases, however, in a very large jig where it may be found useful.

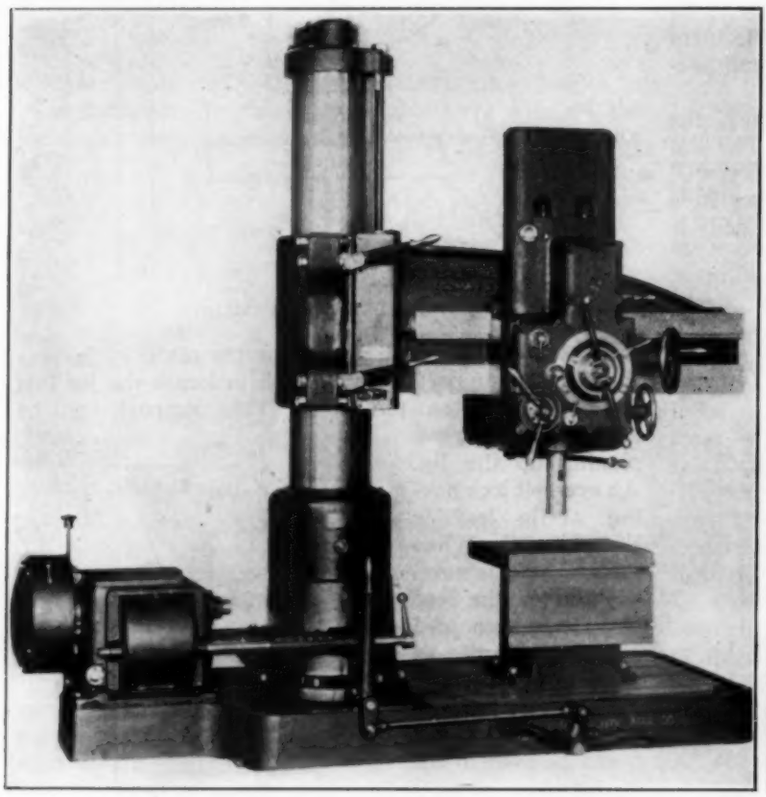
Carlton Heavy-Duty Ball Bearing Radial Drilling Machine

Unit Principle of Construction—Ball Bearing Mountings for Shafts—Centralized and Convenient Control—Balanced Spindle Housing—Diversity of Driving Methods

BY J. V. HUNTER
Western Editor, *American Machinist*

A LATE CREATION among the standard types of machine tools is the new model ball bearing, heavy-duty, geared radial drilling machine made by the Carlton Machine Tool Co., Cincinnati, Ohio, and shown in Fig. 1. The machine is designed and constructed to meet the requirements either of large machine shops or of the jobbing shop. It is built in three sizes, designated as 4, 5 and 6 ft., respectively. In order to reduce the wear and deterioration of the running parts, all are mounted on ball bearings designed to take both the radial and thrust loads. The elimination of friction thus obtained is stated to result in a saving of power and to permit the use of a smaller motor.

The base is heavily ribbed on its under side and has a large working surface that is surrounded by a channel for collecting the coolant and returning it to the reservoirs. Large covered pockets, connected by a tunnel, are provided in the base on each side of the column for



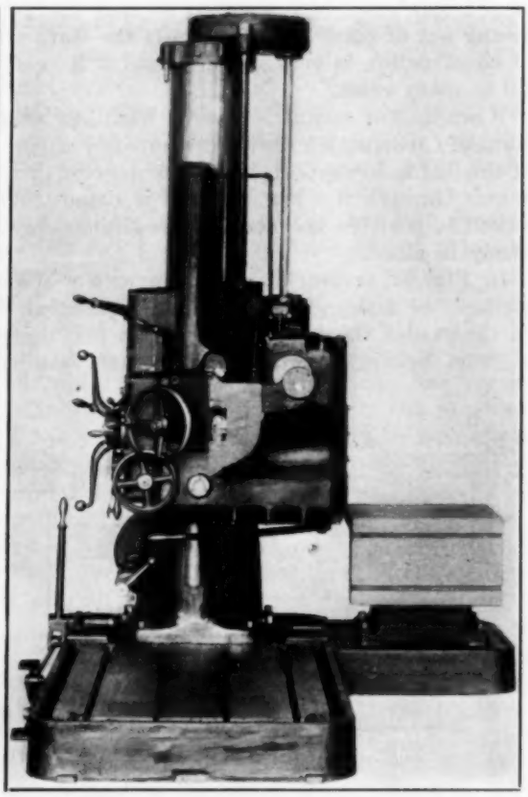


FIG. 1. CARLTON RADIAL DRILLING MACHINE. FIG. 2. END VIEW OF MACHINE EQUIPPED WITH TABLE WING

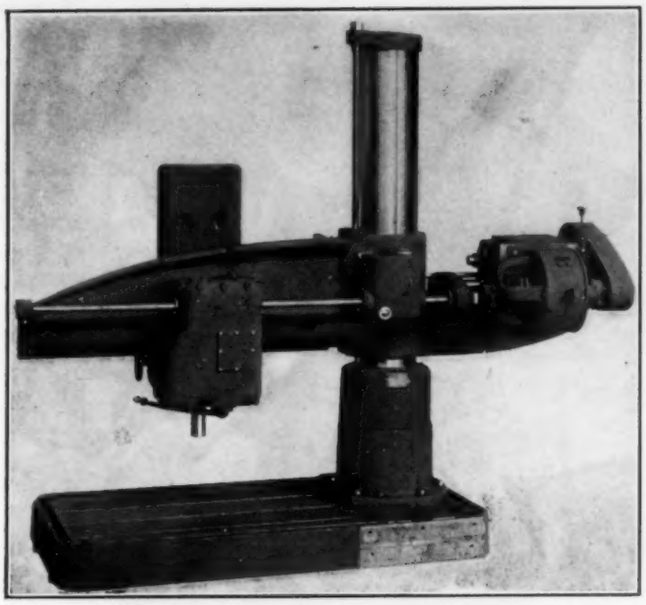


FIG. 3. REAR VIEW SHOWING CONSTANT-SPEED MOTOR MOUNTED ON ARM EXTENSION

storing the coolant. An opening is provided on each side so that the reservoirs may be cleaned without removing the pump. An extension on the rear of the base serves either for mounting a speed-gear box or a variable speed motor.

The Column

Neither the inner nor the outer column is split, and the locking is accomplished by two rings operated either by a hand lever or by the treadle attached to the base. The treadle is placed where it will be convenient to the operator, and it permits him to release the column in order to change the position of the arm and again lock it in place without moving to and from the column. This form of locking equipment is standard on all machines and takes the place of the pneumatic clamps sometimes specified.

The column is hung from the top on a ball-thrust and large radial bearing, and at its point of contact with the stump-knee is guided by a roller bearing. This mounting eliminates the friction that ordinarily occurs in swinging the arm and column when positioning the drill spindle, and therefore the action requires but little effort on the part of the operator. The stump-knee below the column contains the bevel gears connecting the drive with the vertical shaft. The gears run in a bath of oil and are mounted on sleeves or shafts supported at both ends by ball-bearings.

The column is a semi-steel casting and is ground to a finish over the section that affords a bearing for the arm. The vertical drive shaft through the column carries the power to the column cap where it is transmitted through three steel gears, mounted on ball-bearings, and thence through the vertical drive shaft to the arm, Fig. 2.

The Arm

The arm has a box-form section, with a rib of I-section along its top that serves to give it additional stiffness. The arm is clamped in position on the column by two hand levers fitted with an interlocking device so that the gear train on the elevating screw cannot be engaged while the arm is clamped. Conversely, the levers are held in an upright position and cannot drop and lock the arm while the elevating screw is operating. The elevating-screw gear-drive train is located in a unit housing mounted on the rear of the arm, Fig. 3, and containing the necessary bevel gears and a tumbler gear. The elevating screw nut revolves about the elevating screw, which remains stationary. When the arm travels to its maximum height on the column, it is stopped automatically by means of a plunger control; also, when the arm is lowered, if it or the spindle head should meet any obstruction, it stops automatically.

The Spindle Housing

The spindle head, Fig. 4, is entirely enclosed and is one complete unit consisting of a number of individually complete subunits. The arm is finished with long flat ways for bearing the head, which is clamped to the arm by dovetailed gibs. The head is designed to be in balance on the long flat guide on which it rests on the arm, thus giving it a freedom of movement, so that it can be pulled or pushed the full length of the arm if the operator desires to do so and avoid using the hand traverse wheel.

The spindle head may be traversed by the handwheel *A*, and locked in place on the arm by the binding lever *B*. Four spindle speeds, controlled by the levers *C* and *D*, can be obtained by gearing incorporated in the spindle housing, and these speeds, together with six changes afforded by the standard speed box, give a total of 24 speeds, ranging in geometrical progression from 18 to 800 r.p.m. All spindle gears are of heat-treated chrome-nickel steel. All shafts in the spindle head, together with the spindle itself, run in ball bearings. The spindle has a low-hung drive, with its drive gear mounted on and double-splined to the largest diameter of the spindle. The spindle is made of high-carbon

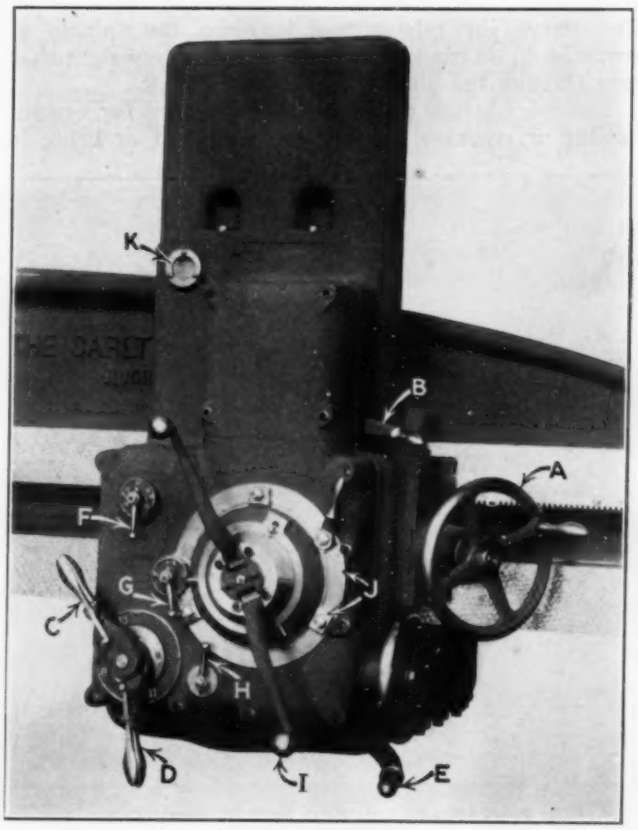
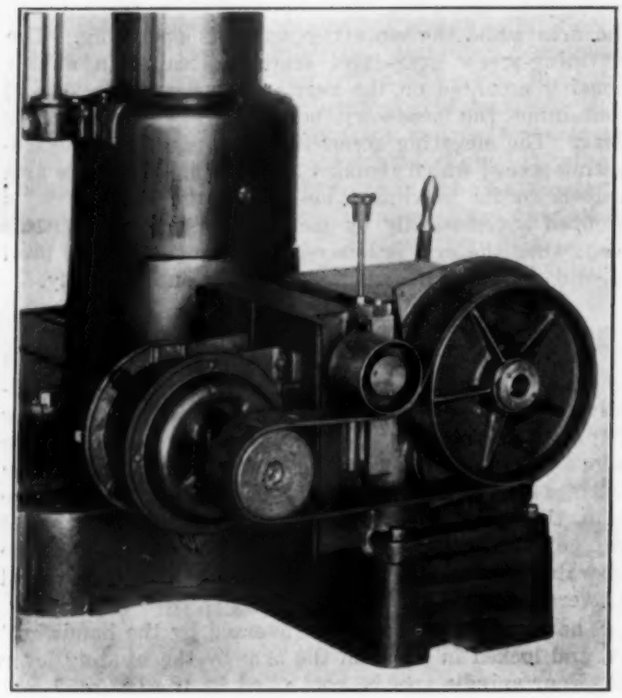


FIG. 4. THE SPINDLE HEAD SHOWING CONTROL LEVERS



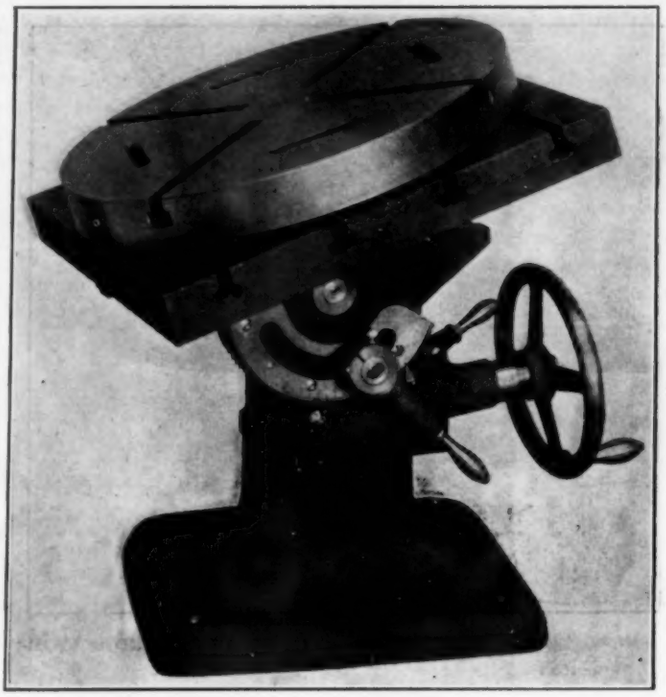


FIG. 5. BELT DRIVE FOR MACHINE EQUIPPED WITH CONSTANT-SPEED MOTOR
FIG. 7. CARLTON UNIVERSAL WORK TABLE

steel and is fitted with a hardened steel renewable tang inserted in the spindle nose. The lever *E* is provided for starting, stopping and reversing the spindle.

Spindle Feed Mechanism

The spindle feed mechanism is a sub-unit of the head, and gives twelve feed changes controlled by the levers *F* and *G*, ranging from 0.005 to 0.069 in. per spindle revolution. The power feed is engaged by the lever *H*. The sleeve for raising and lowering the spindle is mounted on its top and balanced by a counterweight that acts through the pinion of the spindle rack.

The quick-acting clutch levers *I* are used for rapidly raising or lowering the spindle to clear it or bring it down to the work. The power feed on the spindle is fitted with automatically acting stops that control its maximum travel up or down. It also has a depth dial *J* on which dogs may be set for stopping the feed at any required point. The spindle housing is filled with 10 gal. of oil and has a pump that throws the lubricant constantly to all gears and bearings. A glass-covered peep-hole *K* is provided for observation of the flow of oil.

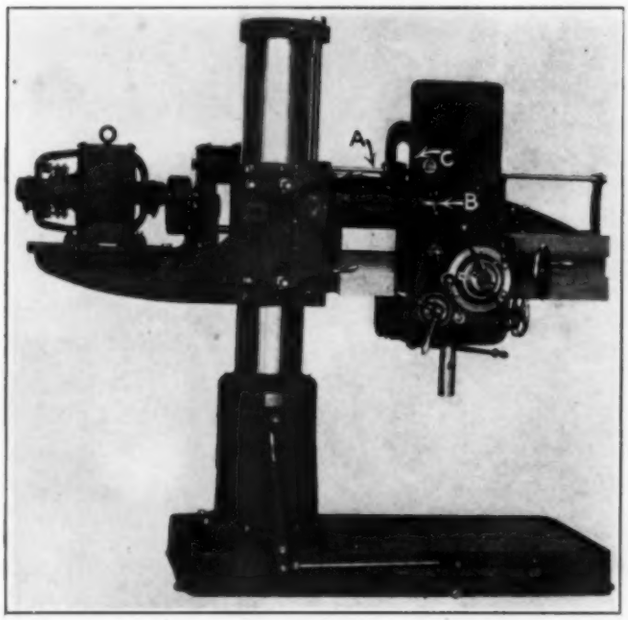


FIG. 6. VARIABLE-SPEED MOTOR MOUNTED ON ARM EXTENSION

The Speed Box

The speed box is located behind the column on an extension of the base, Fig. 1, and is controlled by a rod that passes through a boss on the stump-knee to a lever conveniently placed for the operator. The change gear mechanism gives six speeds and is designed so as to roll in, with a pawl to keep the gears continually in motion in order to avoid shocks due to putting them into motion when changing the speeds. The speed box is entirely enclosed to keep it free from dirt and the gears run in an oil bath. The speed-box drive is connected with the stump-knee by a standard coupling that makes all machines interchangeable with respect to their drive.

Methods of Machine Drive

Either pulley or motor-driven machines can be furnished; and unless a variable speed motor is required, the machines are all equipped with the standard speed-gear drive box. The machine shown in Fig. 1 is motor driven, and for belt drive the belt case at the left is replaced by a standard pulley and belt case for a tight and loose pulley and fitted with a belt shifter. The loose pulley is mounted on roller bearings. A belt drive carries the power from the motor to the speed box, and is shown in Fig. 5 with the belt guard removed. The idler pulley has a mounting that permits its adjustment for tightening the belt by means of a screw and hand-nut that can be operated from the front of the machine. When a variable-speed motor is used for driving, it is

mounted on the base in place of the speed box and connected with the shaft extension from the stump-knee by a set of reducing gears.

Another design of the machine arranges for mounting the motor on an extension of the arm to the rear of the column, and a variable speed motor with its starting mechanism and control rheostat is shown thus mounted in Fig. 6. The shaft *A* mounted on special brackets from the arm has been provided for manipulating the motor control mechanism, and is worked by the operating handle *B* through a chain drive concealed in the case *C*. A constant-speed motor with belted drive mounted on the extension of the arm can also be employed. This form is illustrated in Fig. 3, the arrangement of its belting being identical with that shown in Fig. 5.

The table wing, Fig. 2, is a separate unit and can be furnished as an extra attachment. A boss is finished on the right side of the base, to which the table wing can be bolted and keyed into position. Another attachment is the universal table, Fig. 7, with a head mounted on ball-bearings that can be adjusted to any angle from zero to 90 deg. by means of a worm drive. A graduated scale is provided for setting the table at the desired angle, and a pair of locking levers secures it in place. For making the table fully universal, the additional round table mounted on top of the square head can be furnished.

Specifications: Built in three sizes with 4, 5 and 6-ft. arms. Respective capacities: Drills to center of, 8 ft. 3½ in., 10 ft. 4 in. and 12 ft. 3½ in. circle. Maximum distance between spindle and base, 5 ft., 5 ft. 6½ in. and 6 ft. 3½ in. Feed to spindle, 18 in. Taper hole in spindle, No. 5. Twelve feeds ranging from 0.005 to 0.069 in. per spindle revolution. Twenty-four speeds ranging from 18½ to 800 r.p.m. Tight and loose pulley drive, 14x4½ in. Working surface of table, 22x28 in. Working surface of base, 3 ft. 6 in. x 4 ft. 5 in., 4 ft. x 5 ft. 5 in. and 4 ft. x 6 ft. 5 in. Floor space, 3 ft. 6 in. x 9 ft. 6 in., 4 ft. x 10 ft. 7 in. and 4 ft. x 11 ft. 7 in. Net weight, 9,000, 11,500 and 14,800 lb.

Some New England Railroad Shop Repairs

Pouring Driving Box Hub Liners—Milling Crossheads and Rod Brasses—A Special Milling Cutter—Using Air Clamps—Locomotives Staggered to Save Room

BY FRED H. COLVIN
Editor, *American Machinist*

THE shops at North Billerica, Mass., handle heavy repairs for a large part of the whole Boston and Maine Railroad system. This includes repairs to the electric locomotives which are used through the Hoosac Tunnel in the western part of the state. These locomotives have incidentally, given excellent service and stay out of the shop for long periods.

One of the interesting methods is that used in pouring the hub liners into the driving boxes. This differs in some ways from the usual practice. Figs. 1 and 2 show how this is done.

The babbitt is melted in the furnace shown, the air and liquid fuel coming in at the left end. The driving box to be babbitted is mounted on the small four-wheel truck shown in the foreground and is prepared for holding the babbitt in the usual way. The partial ring *A* forms the outside of the mold, the casting *B* holding the ring in position during the pouring operation.

Fig. 2 shows the hub lining just after it has been poured, showing the ring completely filled with the metal. The truck is simply run into its proper position near the rotary furnace, which is then turned over by the pilot wheel shown at the right and the babbitt poured directly into the mold, obviating the use of a ladle.

Two rather interesting milling operations are shown in Figs. 3 and 4. Fig. 3 shows how two strings of four crossheads each are mounted for milling on an Ingersoll machine. This view also shows the arrangement of the two gangs of inserted tooth cutters, each gang consist-

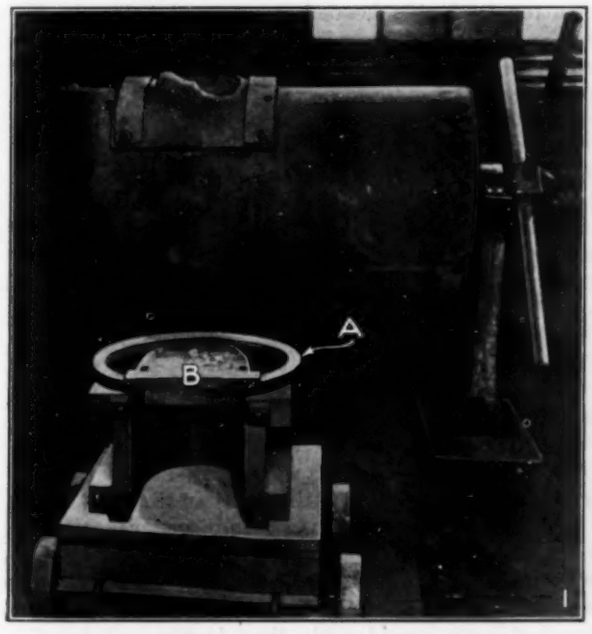


FIG. 1. READY TO POUR A HUB LINER

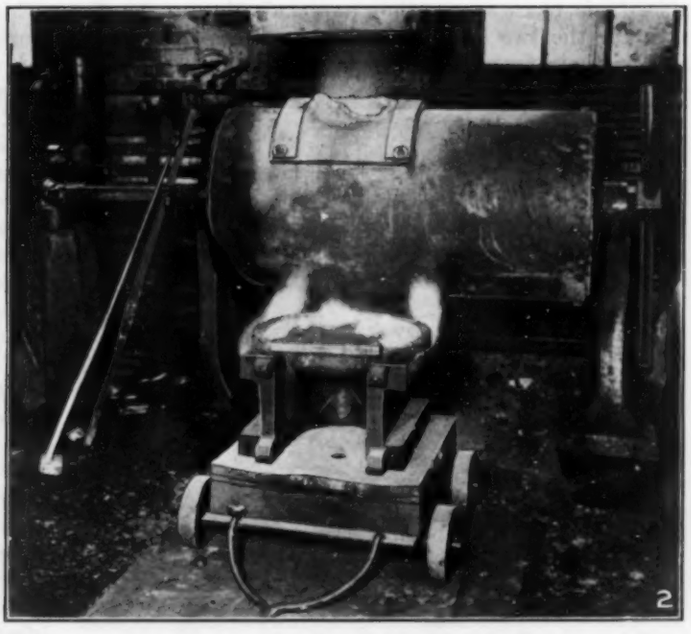


FIG. 2. THE HUB LINER POURED

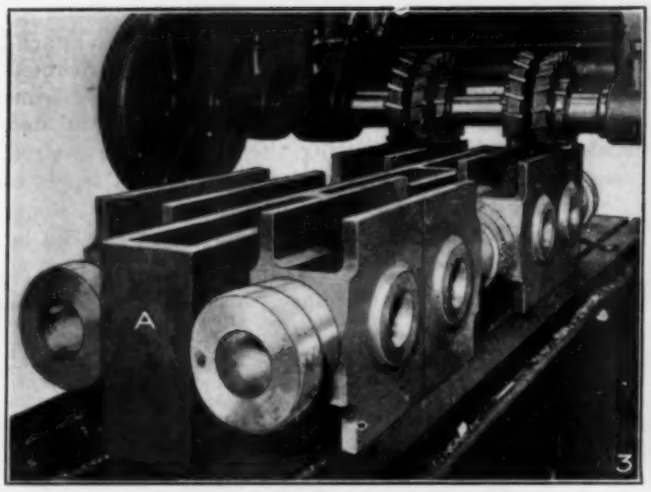


FIG. 3. STRING-MILLING LOCOMOTIVE CROSSHEADS

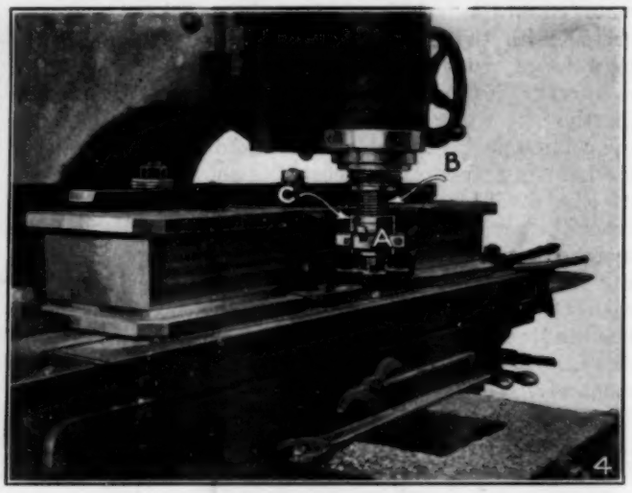


FIG. 4. AN UNUSUAL MILLING CUTTER

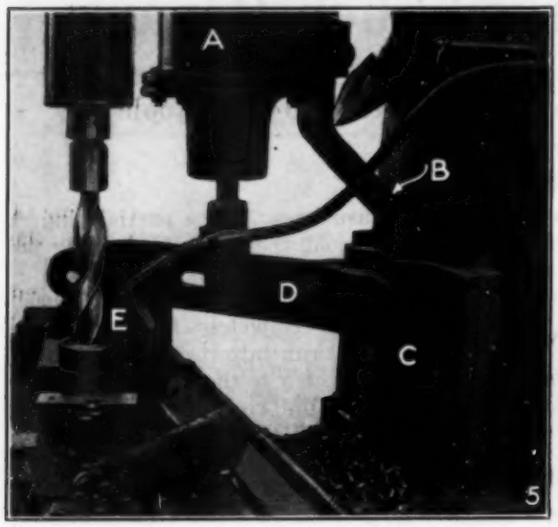


FIG. 5. VERTICAL AIR CLAMP ON DRILLING MACHINE.

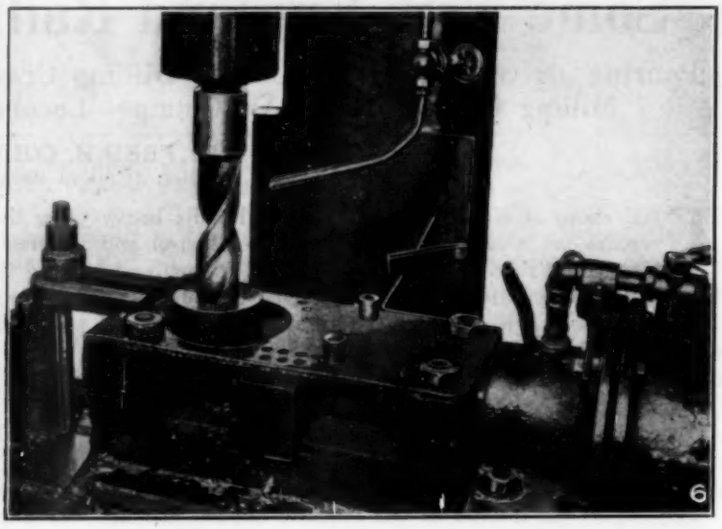


FIG. 6. AIR CLAMP FOR VALVE MOTION BUSHINGS

ing of four cutters. The crossheads are squared up by the central block *A* fastened in the center of the machine table. This block spaces the crossheads the proper distance for the two gangs of milling cutters to machine them in their proper relation to the piston rod hole.

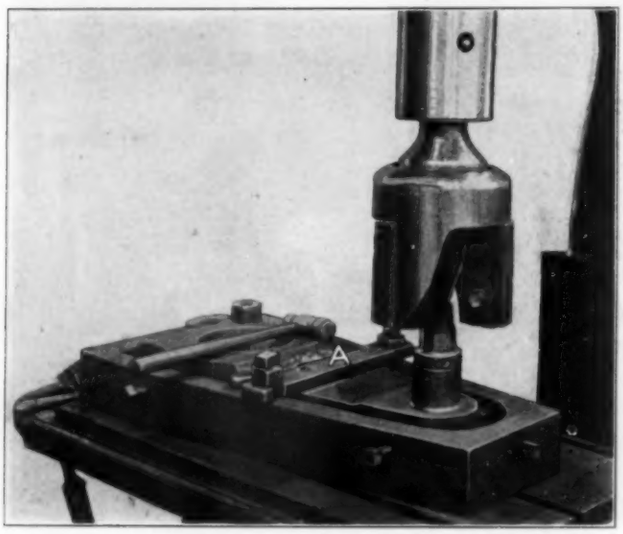


FIG. 7. TURNING CRANKPIN ON HALF CRANK

A somewhat unusual type of milling cutter is shown in Fig. 4 in use on a Becker vertical milling machine. This cutter is double headed, each head being in the form of a cross and carrying four cutting tools, each of which is adjustable separately for resetting after grinding.

The upper head *A* is adjustable with relation to the lower head by simply turning it on the screw *B* which forms the body or spindle of the milling cutter. The head *A* is threaded on the inside and can be adjusted to any desired position within its range, being fastened at the desired point by means of the locknut *C*. This cutter is used for milling the flanges the correct distance from each other, the adjustment making it possible to secure the desired width between them.

The use of compressed air for various purposes has long been one of the outstanding features in railroad shops. In some places, such as crane hoists, it has to a great extent been superseded by the electric motor. But for clamping work while being machined, it seems likely to hold sway for sometime. It is, in fact, being used more and more for this purpose in general machine shop work.

Two air clamping devices for drilling machine work are shown in Figs. 5 and 6. These are very simple devices but save considerable time in the course of a month in the handling of work on and off the machine.

FIG. 8. A GENERAL VIEW OF THE ERECTING SHOP

In Fig. 5 the air cylinder *A* is mounted on the frame of the drilling machine, being connected at the bottom by means of the brace *B*. The bracket *C* carries the arm *D*, which in turn is provided with the equalizing or floating shoe *E*. The bracket *C* is provided with five holes for the fulcrum pin of the lever so as to utilize it to the best advantage for work of various thicknesses. All that is necessary for the operator to do is to place the work to be drilled in the desired position, turn the air valve handle and the work is clamped instantly. Releasing the air loosens the work.

A somewhat different fixture is shown in Fig. 6. This is a special fixture for holding valve motion bushings and enabling them to be handled very rapidly. The air cylinder is horizontal in this case.

The method of turning the crankpin on the half crank for the valve motion is shown in Fig. 7. This shows the box fixture used for centering the half crank forging so as to bring the crankpin in the desired position with relation to the hole at the other end. The latch *A* is simply to offset any lifting tendency. A sweep tool or hollow mill, is used for turning the pin and has been found very satisfactory.

A general view of the shop is shown in Fig. 8. A somewhat unusual feature may be noted in the case of the two rows of locomotives along the sides of the bay at the rear. These locomotives are set staggered in the same way as automatic screw machines are generally arranged, so as to enable boiler tubes to be removed or replaced, without allowing the usual distance between every locomotive and to economize shop space.

This view also gives a good idea of the substantial shop construction and the way in which three rows of locomotives can be handled in the erecting bay.

Slip of Involute Gear Teeth

Gear Efficiency Increased and Wear Decreased by Using Large Numbers of Teeth—Shorter Addendum Reduces Slip—Friction Losses Increase with Increases in Angle of Obliquity

BY A. B. COX

THE intent of these data and curves is to show that the efficiency of gears can be increased and the wear decreased by choosing large numbers of teeth; that the use of gears of shorter addendum or greater obliquity of the line of action reduces slip and increases the percentage of rolling contact; and that the gain in efficiency from increasing the angle of obliquity is offset by the increased friction losses in the bearings in proportion as the angle increases.

There is shown in Fig. 1 an involute pinion driving an involute gear. Since at point O_1, where the pinion teeth first make contact with the gear teeth, a is in contact with f, and when the teeth reach the line of centers and the contact point is at O_2, b is in contact with e, it is evident that in moving through the arc of approach the length of pinion involute ab acts on the length of gear involute ef. If length ab were equal to length ef there would be true rolling contact and no slipping. When they are unequal (as they always are) the actual net slip is equal to the difference in length of ab and ef.

$$\text{Approach slip } S_A = ef - ab \qquad (1)$$

$$\text{The length of rolling contact (net)} = ab \qquad (2)$$

Similarly the slip, while the pinion rotates through the arc of recess, is

$$S_R = bc - de \qquad (3)$$

$$\text{and} \qquad \text{Length of rolling contact} = de \qquad (4)$$

The total net slip of the pinion tooth on the gear tooth for the entire arc of contact is (1) + (3), or

$$S_T = ef - rb + bc - de \qquad (5)$$

$$\text{and the net rolling contact} = ab + de \qquad (6)$$

If (5) and (6) be divided by the radius r of the pinion, curves for gears and pinions of various numbers of teeth

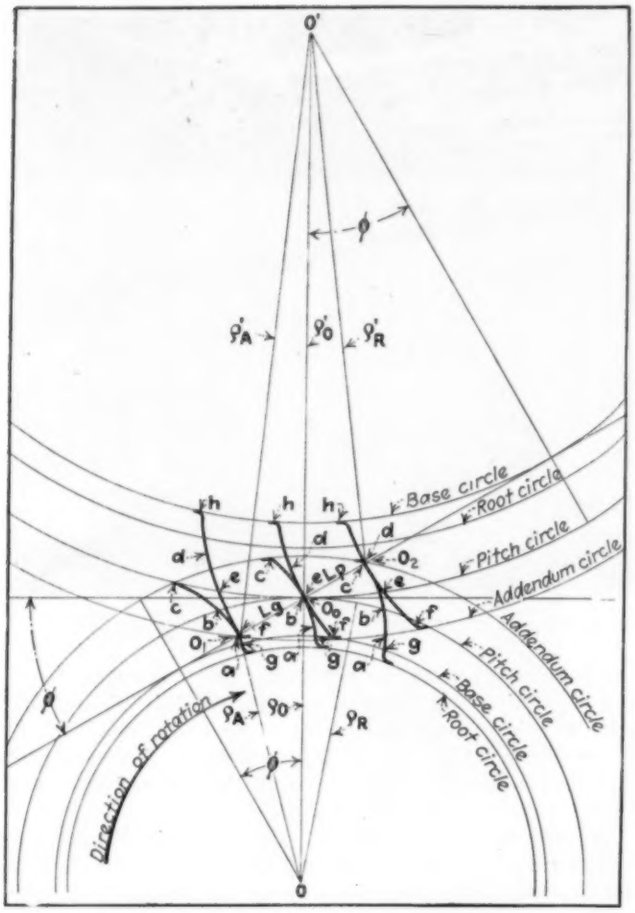


FIG. 1. INVOLUTE PINION AND GEAR

and ratios can be plotted for convenient comparison of different sets of gears as regards wear, efficiency, etc.

The formula for the length L_I of an involute is fortunately very simple (see any good standard calculus):

$$L_I = \frac{r_B \theta^2}{2} \tag{7}$$

r_B in the case of involute gears is, of course, the radius of the base circle:

$$r_B = r \cos \phi \tag{8}$$

Substituting (8) in (7)

$$L_I = \frac{r \cos \phi\, \theta^2}{2}. \tag{9}$$

The value of $\theta = \sqrt{H^2 \sec^2 \phi - 1}$ (10)

and $\theta^2 = H^2 \sec^2 \phi - 1$ (11)

(See *American Machinist*, vol. 54, page 559, "Angles of Approach, Recess and Contact of Involute Gears".) Substituting in (9) we obtain

$$L_I = \frac{r \cos \phi}{2} (H^2 \sec^2 \phi - 1) \tag{12}$$

By means of formula (12) the lengths of involute *ab*, *bc*, et al, can be calculated and the value of S_T (see (5)) determined.

In the *American Machinist*, vol. 53, page 899, "Derivation of a Formula to Determine Number of Teeth in Contact of Two Meshing Gears," the length of $O_1O_o = L_g$ was shown to be

$$R\left[-\sin \phi + \sqrt{\sin^2 \phi + \frac{4}{N^2}(N+1)}\right]$$

and $O_oO_2 = L_p = r\left[-\sin \phi + \sqrt{\sin^2 \phi + \frac{4}{n^2}(n+1)}\right]$

These quantities within the brackets occur so frequently that for convenience they have been given the symbol "Z". $L_g = RZ_g$ and $L_p = rZ_p$. $K = \frac{R}{r}$. $R = Kr$. $L_g = KrZ_g$.

$$\rho_A = \sqrt{r^2 + L_g^2 - 2rL_g \cos (90 - \phi)}$$
$$= \sqrt{r^2 + K^2r^2Z_g^2 - 2r^2 Z_g \sin \phi}$$
$$= r\sqrt{1 + K^2Z_g^2 - 2Z_g \sin \phi}.$$

$$H_A = \frac{\rho_A}{r} = \sqrt{1 + K^2Z_g^2 - 2Z_g \sin \phi}.$$

$$\theta_A^2 = H_A^2 \sec^2 \phi - 1$$
$$= [(1 + K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi - 1]$$
$$= [(K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi + \tan^2 \phi].$$

Length of involute $ag = \frac{r\theta_A^2 \cos \phi}{2}$.

$$= \frac{r \cos \phi}{2} [(K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi + \tan^2 \phi] \tag{13}$$

At O_o, $\rho_o = r$. $H_o = 1$. $\theta^2_o = \sec^2 \phi - 1 = \tan^2 \phi$.

Length of involute $O_o g = \frac{r \cos \phi}{2} \tan^2 \phi = bg$ (14)

Length of involute $ab = bg - ag$

$$= \frac{r \cos \phi}{2} [\tan^2 \phi - (K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi - \tan^2 \phi]$$
$$= \frac{r \sec \phi}{2} [2KZ_g \sin \phi - K^2Z_g^2] \tag{15}$$

$$\rho'_A = R + \frac{1}{P} = \frac{R(N+2)}{N}. \quad H'_A = \frac{\rho'_A}{R} = \frac{N+2}{N}.$$

$$\theta'^2_A = \frac{(N+2)^2}{N^2} \sec^2 \phi - 1.$$

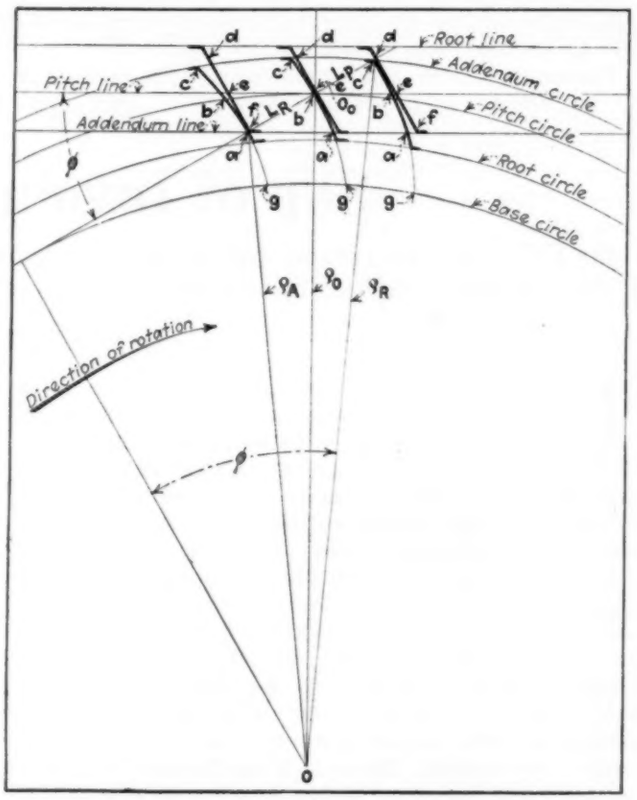


FIG. 2. INVOLUTE RACK AND PINION

Length of involute $hf = \frac{R\theta'^2_A \cos\phi}{2} =$

$$\frac{R\cos\phi}{2}\left[\frac{(N+2)^2}{N^2}\sec^2\phi - 1\right] \quad (16)$$

Length of involute $eh = \frac{R\cos\phi}{2}\tan^2\phi$ (17)

Length of involute $ef = hf - eh$

$$= \frac{R\cos\phi}{2}\left[\frac{(N+2)^2}{N^2}\sec^2\phi - 1 - \tan^2\phi\right]$$

$$= \frac{R\cos\phi}{2}\left[\frac{(N+2)^2}{N^2}\sec^2\phi - \sec^2\phi\right]$$

$$= \frac{R\sec\phi}{2}\left[\frac{(N+2)^2}{N^2} - 1\right]$$

$$= \frac{R\sec\phi}{2}\left[\frac{N^2+4N+4-N^2}{N^2}\right]$$

$$= \frac{R\sec\phi}{2}\left[\frac{4(N+1)}{N^2}\right] \quad (18)$$

$$= 2Kr\sec\phi\left[\frac{Kn+1}{K^2n^2}\right] \quad (19)$$

$$= \frac{r\sec\phi}{2}\left[\frac{4K(N+1)}{N^2}\right] \quad (20)$$

Slip of approach $S_A = ef - ab$

$$= \frac{r\sec\phi}{2}\left[\frac{4K(N+1)}{N^2} + K^2Z_g^2 - 2KZ_g\sin\phi\right] \quad (21)$$

Similarly, $\rho_R = r + \frac{1}{P} = r\frac{n+2}{n}$

$$H_R = \frac{n+2}{n};$$

$$\Theta^2_R = \frac{(n+2)^2}{n^2}\sec^2\phi - 1.$$

Length of involute $gc = \frac{r\cos\phi}{2}\left[\frac{(n+2)^2}{n^2}\sec^2\phi - 1\right]$ (22)

Length of involute $gb = \frac{r\cos\phi}{2}\tan^2\phi$ (23)

Length of involute $bc = gc - gb$

$$= \frac{r\cos\phi}{2}\left[\frac{(n+2)^2}{n^2}\sec^2\phi - 1 - \tan^2\phi\right]$$

$$= \frac{r\cos\phi}{2}\left[\frac{(n+2)^2}{n^2}\sec^2\phi - \sec^2\phi\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{(n+2)^2}{n^2} - 1\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{n^2+4n-n^2+4}{n^2}\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{4n-4}{n^2}\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2}\right] \quad (24)$$

And by trigonometry:—

$$\rho_R = \sqrt{R^2 + L_p^2 - 2RL_p\cos(90-\phi)}$$

$$L_p = rZ_p.$$

$$\rho_R = \sqrt{R^2 + r^2Z_p^2 - 2rRZ_p\sin\phi}.$$

$$r = \frac{R}{K}.$$

$$\rho_R = \sqrt{R^2 + \frac{R^2Z_p^2}{K^2} - \frac{2R^2Z_p}{K}\sin\phi}$$

$$= R\sqrt{1 + \frac{Z_p^2}{K^2} - \frac{2Z_p}{K}\sin\phi}.$$

$$H'_R = \sqrt{1 + \frac{Z_p^2}{K^2} - \frac{2Z_p^2}{K}\sin\phi}.$$

$$\theta'^2_R = \left[(1 + \frac{Z_p^2}{K^2} - \frac{2Z_p}{K}\sin\phi)\sec^2\phi - 1\right].$$

$$\theta'^2_R = \left[\left(\frac{Z_p^2}{K^2} - \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right].$$

Length of involute $hd =$

$$\frac{R\cos\phi}{2}\left[\left(\frac{Z_p^2}{K^2} - \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right] \quad (25)$$

Length of involute $he = \frac{R\cos\phi}{2}\tan^2\phi$ (26)

Length of involute $de = he - hd$

$$= \frac{R\cos\phi}{2}\left[\tan^2\phi - \left(\frac{Z_p^2}{K^2} - \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi - \tan^2\phi\right]$$

$$= \frac{r\sec\phi}{2}\left[2Z\sin\phi - \frac{Z_p^2}{K}\right]. \quad (27)$$

Slip of recess $= bc - de$

$$= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2} + \frac{Z_p^2}{K} - 2Z_p\sin\phi\right] \quad (28)$$

Total slip = slip of approach + slip of recess.

S_T = (21) + (28).

$$= \frac{r\sec\phi}{2}\left[\frac{4K(N+1)}{N^2} + K^2Z_g^2 - 2KZ_g\sin\phi + \frac{4(n+1)}{n^2} + \frac{Z_p^2}{K} - 2Z_p\sin\phi\right]. \quad (29)$$

For 1 to 1 ratio of gears, $K = 1$, $Z_p = Z_g$, and $n = N$. (29) therefore reduces to:

$$\frac{r\sec\phi}{2}\left[\frac{8(n+1)}{n^2} + 2Z^2 - 4Z\sin\phi\right].$$

$$S_T = r\sec\phi\left[\frac{4(n+1)}{n^2} + Z^2 - 2Z\sin\phi\right]. \quad (30)$$

This can be reduced still further as follows:

$$Z = \left[-\sin\phi + \sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)}\right].$$

$$Z^2 = \sin^2\phi - 2\sin\phi\sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)} + \sin^2\phi + \frac{4}{n^2}(n+1).$$

$$-2Z\sin\phi = +2\sin^2\phi - 2\sin\phi\sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)}$$

$$Z^2 - 2Z\sin\phi = 4\sin^2\phi - 4\sin\phi\sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)} + \frac{4}{n^2}(n+1)$$

$$= -4Z\sin\phi + \frac{4n+1}{n^2}.$$

$$\frac{4(n+1)}{n^2} = Z^2 + 2Z\sin\phi. \quad (30\text{-a})$$

$$S_T = 2r\sec\phi\,Z^2 \quad (31)$$

For the case of rack and pinion, formula (29) becomes indeterminate and a new equation becomes necessary. Referring to Fig. 2, this is derived as follows:

Addendum of rack teeth $= \frac{1}{p} = \frac{1}{\frac{n}{2r}} = \frac{2r}{n}$.

$$L_R = \frac{2r}{n \sin \phi}.$$

$$\text{Length of } ef = \frac{2r}{n} \sec \phi. \tag{32}$$

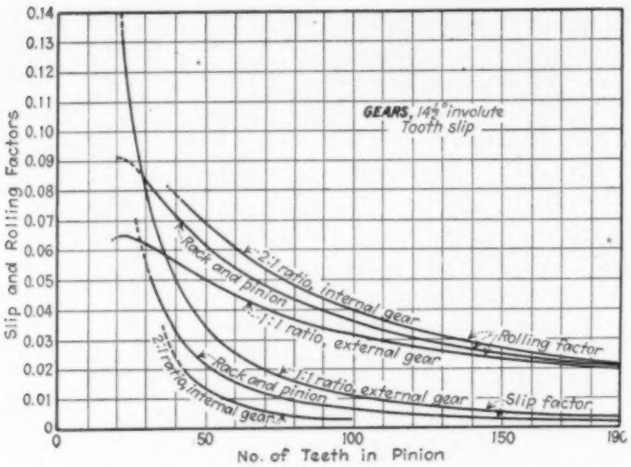


FIG. 3. TOOTH SLIP, 14½ DEG. INVOLUTE

By trigonometry:

$$\rho_A = \sqrt{r^2 + L_R^2 - 2rL_R \cos\ (90 - \phi)}$$

$$= \sqrt{r^2 + \frac{4r^2}{n^2 \sin^2 \phi} - \frac{4r^2 \sin \phi}{n \sin \phi}}$$

$$= r \sqrt{1 + \frac{4}{n^2 \sin^2 \phi} - \frac{4}{n}}.$$

$$H_A = \sqrt{\frac{n^2 + 4\ \text{cosec}^2 \phi - 4n}{n^2}}.$$

$$\theta_A^2 = \left[\left(\frac{n^2 + 4\ \text{cosec}^2 \phi - 4n}{n^2}\right) \sec^2 \phi - 1\right].$$

$$\theta_A^2 = \left[\left(\frac{4\ \text{cosec}^2 \phi - 4n}{n2}\right) \sec^2 \phi + \tan^2 \phi\right].$$

Length of involute $ga =$

$$\frac{r \cos \phi}{2}\left[\left(\frac{4\ \text{cosec}^2 \phi - 4n}{n^2}\right) \sec^2 \phi + \tan^2 \phi\right] \tag{33}$$

$$\text{Length of involute } gb = \frac{r^2 \cos \phi}{2} \tan^2 \phi. \tag{34}$$

Length of involute $ab = gb - ga$.

Length of Involute ab

$$= \frac{r \cos \phi}{2}\left[\tan^2 \phi - \left(\frac{4\ \text{cosec}^2 \phi - 4n}{n^2}\right) \sec^2 \phi - \tan^2 \phi\right]$$

$$= 2r \sec \phi\left[-\left(\frac{\text{cosec}^2 \phi - n}{n^2}\right)\right] \tag{35}$$

$$\text{Slip of approach} = ef - ab$$

$$= 2\ r\ \sec \phi\left[\frac{1}{n} + \frac{\text{cosec}^2 \phi - n}{n^2}\right]$$

$$= \frac{2\ r \sec \phi\ \text{cosec}^2 \phi}{n^2} \tag{36}$$

The recess slip is found in a similar way: $L_p = rZ$. Length of $de = L_p \tan \phi = rZ \tan \phi$, which for convenience is expressed as

$$2\ r\ \sec \phi \left(\frac{Z \sin \phi}{2}\right). \tag{37}$$

$$\rho_R = r + \frac{1}{p} = r\,\frac{n+2}{n}.$$

$$H_R = \frac{n+2}{n}.$$

$$\theta_R^2 = \left(\frac{n+2}{n}\right)^2 \sec^2 \phi - 1.$$

Length of involute gc

$$= \frac{r \cos \phi}{2}\left[\left(\frac{n+2}{n}\right)^2 \sec^2 \phi - 1\right]$$

$$= \frac{r \cos \phi}{2}\left[\frac{(n^2 + 4n + 4) \sec^2 \phi - n^2}{n^2}\right]$$

$$= \frac{r \cos \phi}{2}\left[\frac{4(n+1)}{n^2} \sec^2 \phi + \tan^2 \phi\right] \tag{38}$$

$$\text{Length of } gb = \frac{r \cos \phi}{2} \tan^2 \phi \tag{39}$$

Length of $bc = gc - gb$

$$= \frac{r \cos \phi}{2}\left[\tan^2 \phi + 4\,\frac{n+1}{n^2} \sec^2 \phi - \tan^2 \phi\right]$$

$$= 2r \sec \phi\,\frac{n+1}{n^2}. \tag{40}$$

$$\text{Recess slip} = bc - de$$

$$= 2r \sec \phi\left[\frac{n+1}{n^2} - \frac{Z \sin \phi}{2}\right]. \tag{41}$$

From (30-a), (41) becomes $2r \sec \phi\,\frac{Z^2}{4}$. (41-a)

Total slip = Approach slip + Recess slip = (36) + (41-a),

$$= 2r \sec \phi\left[\frac{\text{cosec}^2 \phi}{n^2} + \frac{Z^2}{4}\right]. \tag{42}$$

The values of slip given by (31) and (41) calculated for $\phi = 14\frac{1}{2}°$, and various values of "n" have been divided by "r" and plotted in Fig. 3. The slip "S" divided by the radius "r" of the pinion has been called the "slip contact factor." These curves afford a ready means of comparing the relative amount of slip of one set of gears with any other set. Tooth interference prevents the dotted portions of the curves having any true meaning. (See *American Machinist*, p. 707, Vol. 53.)

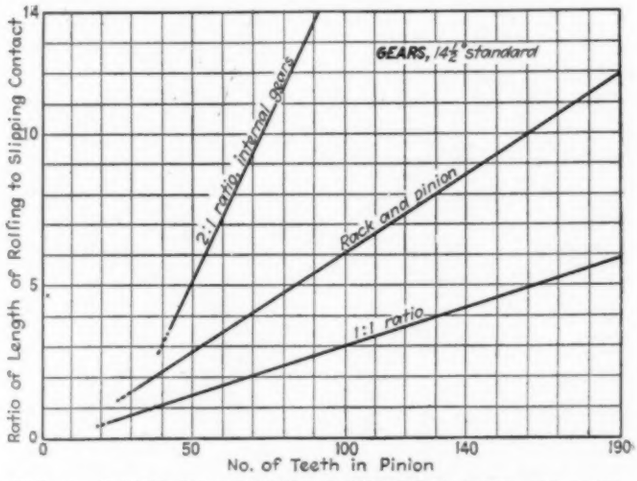

GEARS, 14½° standard
2:1 ratio, internal gears
Rack and pinion
1:1 ratio
Ratio of Length of Rolling to Slipping Contact
No. of Teeth in Pinion

FIG. 4. RATIO OF ROLLING CONTACT FACTOR TO SLIP CONTACT FACTOR PLOTTED AGAINST NUMBERS OF PINION TEETH

The curves for ratios between the 1 to 1 ratio and the rack and pinion ratio, of course, fall between the curves for these two conditions.

The net rolling contact is found by (6) to be as follows:

For any ratio $= ab + de$

$$= r \sec \phi \left[2KZ_p \sin \phi - K^2 Z_p^2 + 2Z_p \sin \phi - \frac{Z_p^2}{K} \right] \quad (43)$$

For 1 to 1 ratio this becomes: $\frac{r \sec \phi}{2}\left[4Z \sin \phi - 2Z^2\right]$.

$$= 2r \sec \phi \, [2Z \sin \phi - Z^2] \quad (44)$$

$$= 8r \sec \phi \left[Z \sin \phi - \frac{n+1}{n^2} \right] \quad (44\text{-a})$$

(see (30) and (31)).

for rack and pinion, rolling contact $= ab + de$,

$$= 2r \sec \phi \left[-\left(\frac{\operatorname{cosec}^2 \phi - n}{n^2} \right) + \frac{Z \sin \phi}{2} \right]$$

$$= 2r \sec \phi \left[\frac{1}{n} - \frac{\operatorname{cosec}^2 \phi}{n^2} + \frac{Z \sin \phi}{2} \right]. \quad (45)$$

(43), (44) and (45) divided by "r" has been called the "rolling contact factor," and plotted in Fig. 3 for $\phi = 14\frac{1}{2}°$ and various values of "n." The ratio of this factor to the slip contact factor has been plotted in Fig. 4 for various numbers of pinion teeth. It is interesting to note that these ratios are straight lines. The ratios of rolling to slipping plotted in Fig. 12 are not straight lines as will be seen later because plotted against angles of approach and recess.

(To be continued in next week's issue.)

Employment by Mail

By H. M. Fitz

We have found out through the columns of the *American Machinist* that we can get the right men by advertising in the right way; now let us find out something about employment by mail, as there are no doubt many firms that hire thousands of employees by mail, and probably many who have had experiences similar to ours, as follows:

Not getting the desired results with the application blank we were using we decided to find out what kinds of blanks some of the other firms were using. So we wrote to thirty-two firms, asking them to kindly send us copies of their blanks, receiving an answer with a blank from twenty-eight. Standardization along this line has probably never been attempted, or at least carried out, as no two blanks were alike. The least number of questions asked was five, and the greatest was fifty-two. Only two had the same number of questions, and these asked them in different ways. This showed that most of them like ourselves were on what we believe to be the wrong track.

Unless a very rigid and expensive follow-up system is used you will never know the correctness, or rather, truthfulness, of the answers to the following questions:

(1) What books do you read? (2) What is your religion? (3) Are you a property owner? (4) Do you carry life insurance? How much? (5) How many do you support? (6) Do you smoke cigarettes? (7) Do you use intoxicants? (8) Have you ever been arrested? If so, what for? (9) What lodges do you belong to? (10) What labor organizations are you a member of?

The above questions are, of course, asked for a reason. They are likewise answered for a reason. The questions themselves will tell the applicant what to answer, with the exceptions, possibly, of Nos. 2 and 9. A two-years' individual record showed that 61 per cent of the applicants employed answered some or all of the above questions incorrectly. An extreme case we will call Employee No. 13. His application nearly two years ago shows that he reads all the best books and mechanical magazines, that he is a church member, owns all kinds of property, carries heavy life insurance, supports a family of six, never smokes or drinks, has never been in trouble of any kind, belongs to several high-class lodges, and is not a member of any labor organization.

The last is the only correct answer out of the ten, according to the follow-up system. It was found that the the man owns nothing, never goes to church, carries no life insurance, is a widower without a family, smokes, chews, and drinks at every opportunity, has a jail record for one night, even though by mistake, and belongs to no lodges or labor organizations. It is easier to lie than to do a lot of explaining.

A psychologist said "That man is unreliable. Why did you keep him for nearly two years when you knew all these bad things about him?"

The answer was "Because we do know this about him—he is one of seven men on one particular class of work, each building the same class of unit on contract, with the same advantages, materials, tools, hours, price; yet he produces nearly twice as many units as the other men in the same length of time and, of course, makes just 89 per cent more money than any of the other six men. He is the best paid mechanic in that department, and the best investment. His aptitude, regularity, loyalty, and conduct in the shop are all good—that is why we keep him. And that is also why all the personal questions are going to be cut off the employment blank. They only tend to make a liar out of the applicant. Get out your application blanks and check them up; you will be surprised to learn what a good bunch of smokeless and drinkless church members have been working for you.

As far as production is concerned, what difference does it make whether a man supports one or six? From a humane standpoint it does make a difference—but maybe the applicant doesn't know the enployer is humane. The answer may mean a turn down, and not many men are willing to convict themselves.

A report returned on one applicant showed that he owned no property as claimed. When asked what he wanted for his property he answered "It is not for sale."

"Well, I am offering you twice the amount you name for it."

"I don't own any property."

"Your application states so."

"Yes, I know. The question was there. I needed a job and answered to the best of my ability."

According to production standards he is an efficient workman and is still on the job. Of course they don't all turn out to be good workmen, but the actual test is what counts and answers the stay-on-the-payroll question, regardless of follow-up returns. As we figure that the information contained in the returns has very little bearing on the employees' loyalty or productivity the value of the information is small compared to the cost of obtaining it. Information is of no use unless correct. Why not save the applicant the humiliation, and the employer a lot of trouble and expense, by eliminating most of the personal questions. A better way, and far more reliable, is to secure what information is required from the applicant's references.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

How the Racks on the Ram of the Greenerd Arbor Press Are Cut

By Amos Ferber

The rack teeth on the ram of an arbor press must be strong beyond the strength of the average gear teeth for the reason that when in service they are subjected to abuse that would soon put an ordinary gear out of

FIG. 1. SET-UP FOR PLANING RACK TEETH

business; and they must be accurately formed and spaced because the pinion is "bottomed" in the rack—that is, the teeth are in contact on both leading and following faces so as to be without backlash, yet are expected to run freely over the whole length of travel.

The larger racks are cut, one tooth at a time, on the planer shown in Fig. 1. A fixture, made for the purpose, holds two racks square with the planer bed and the teeth are cut with a formed tool fed down to a stop and indexed for position by the device shown in Fig. 2 on the back of the cross-rail and saddle.

An accurately-cut guide rack is permanently attached to the rail in such position that it just clears the back of the saddle, and to the latter is fastened a swinging pawl the lip of which is a formed gear tooth fitting the rack. A strap is bolted to the top of the saddle, projecting over the pawl and carrying at its projecting end a set screw to bear upon the pawl.

To move the saddle one position, the set screw is

FIG. 2. DETAILS OF INDEXING MECHANISM

turned back sufficiently to allow the pawl to be lifted over the intervening rack tooth, the saddle moved by means of the cross screw until the pawl drops into the next space and the set screw again run down to bear upon the back of the pawl. As the lip of the pawl is a perfect gear tooth to match the guiding rack, it will not go to the bottom unless the saddle is in exactly the right position.

Two cuts are taken over the length of the rack, the first one taking out most of the stock and leaving but a few thousandths of an inch for the finishing cut. As the spacing for each cut is independent of any other cut, and dependent directly upon the guide rack, there is no possibility of cumulative error.

The method described above is applied only to the larger sizes. Smaller rams have the rack teeth milled, all the teeth being cut at one pass of the cutters as shown in Fig. 3. The cutters are made up in multiples of six and strung on the milling machine arbor to the number required to cut the particular ram in hand. Keyways in the cutters vary in their position

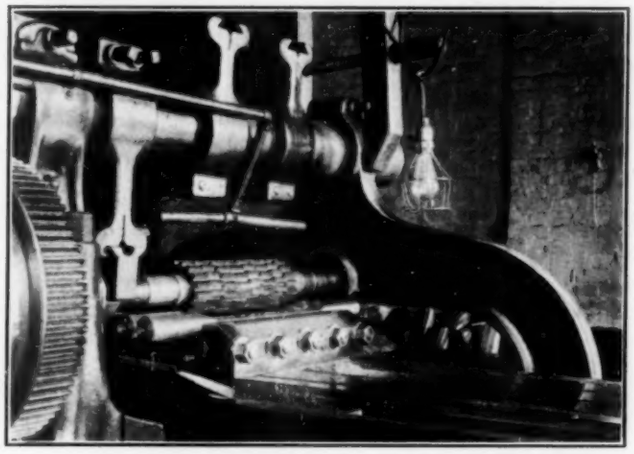


FIG. 3. MILLING THE SMALLER RACKS WITH MULTIPLE CUTTERS

relative to the tooth faces, so that the cutting line is staggered or broken up instead of being parallel with the center line of the arbor, thus reducing the tendency to rhythmic vibration and chatter.

Provision is made to take the thrust of long gangs of cutters by putting intermediate half bearings on the arbor wherever the set-up will allow. Movable supports depending from the overarm are so made as to receive the bearing blocks, which are dove-tailed into the supports at an angle that allows the two parts to go together without removing the cutter arbor.

One of the extra bearings is shown in place in Fig. 3 near the spindle nose. Two others are swung up out of the way.

A heavy casting takes the place of the usual tie bars at the end of the overarm.

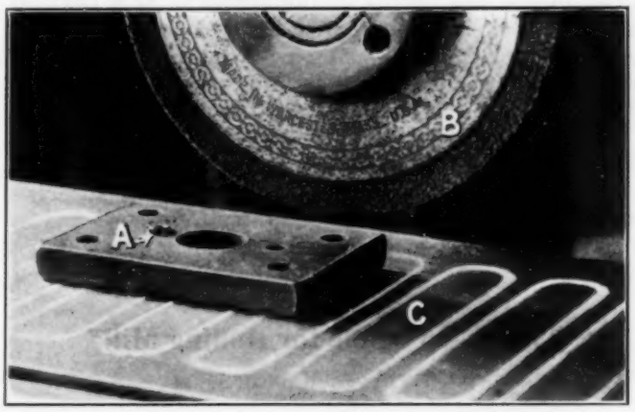
Making Compression Springs of Uniform Length

By E. A. Dixie

The other day I had the job of making some small compression springs. They were made of wire about 0.040-in. diameter and were wound to go inside a ¼-in. hole. The finished springs were required to be *about* ⅜ in. long. There was nothing particular about the length except that all of them had to be the *same* length within a few thousandths.

After the correct size of mandrel was found the springs were wound in lengths of about a foot and before taking the lengths off the mandrel they were compressed to make sure that they would not set after they were in use.

The long coils were next cut with pliers into short lengths of about ⅜ in. and one end of each spring was



GRINDING SPRINGS TO UNIFORM LENGTH

held up against the side of an abrasive wheel and flattened off, free hand. An attempt was then made to use this method of bringing all the springs to uniform length but it was a failure.

The idea of doing the job on the surface grinding machine presented itself and a ¼-in. hole was drilled in an old cast-iron rapping plate, shown in the illustration at *A*, and the plate placed on the magnetic chuck of the grinding machine. This hole was an easy fit for the spring and a spring was dropped into it to see what would happen when it was passed under the grinding wheel *B*. The only thing that happened was that the end of the spring was nicely finished off. There was no tendency for the wheel to pull the spring out of the hole and when some of the springs which were extra long were passed under the wheel they compressed and fed themselves to the wheel.

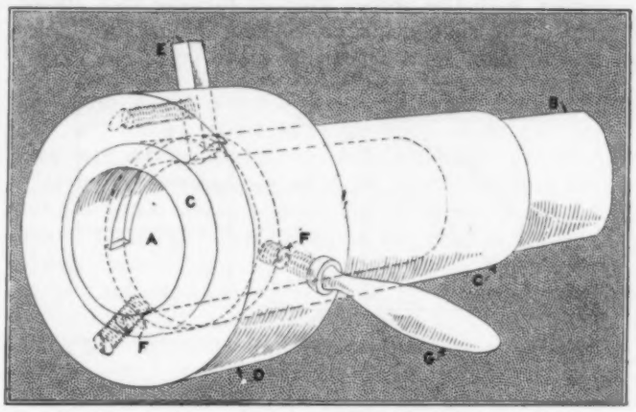
Current was kept on the magnetic chuck *C* all the time, the springs being picked out of the hole by the fingers when they were finished.

When all the springs were finished the difference in length of the longest and the shortest could not be noticed. After the wheel was adjusted to correct height with relation to the table no further adjustment was necessary, the springs being merely fed under the wheel and allowed to remain under its center till the sparks stopped coming.

An External Grooving Tool

By Harry Moore

The sketch shows a tool recently made to cut a groove on the outside of work being machined on a hand screw machine. It was impossible to do the operation



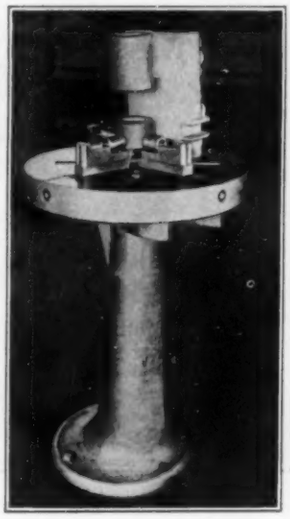
EXTERNAL GROOVING TOOL TO BE USED IN TURRET OF HAND SCREW MACHINE

with the cross-slide, the piece protruding too far, and the cross-slide being in use on the back end of the work. The hole *A* is concentric with the shank *B*, the outside *C* being eccentric. Collar *D* held the tool *E* and was held in place by the round-edge screws *F* which engaged in a groove cut in *C*. These screws were adjusted, then locked; one by another screw, and the other by the handle *G*. A slot cut in the side of *C* allows the tool to reach the work, and the end of this slot acts as a stop. The material being machined is brass.

An Assembling Fixture

By Bert Towler

A useful assembling stand is shown in the accompanying illustration. A round pedestal open at the front and provided with shelves to hold tools, is bolted to the floor in any convenient position and the upper surface is supplied by an old four-jawed independent chuck. The chuck jaws may be removed if desired and the face of the chuck used as a table; or with the jaws in place, any shape of piece within their capacity may be held firmly. The stand is shown with a piece of work held by the chuck jaws ready for reaming.



ASSEMBLING STAND

Turning a Large Hollow Spherical Casting

By E. Jullien

Director of Works A. Savy-Jeanjean et Cie., Courbevoie, Paris, France

The castings, one of which is shown in the drawing and halftone, are used in soap machinery. They must be machined where indicated by a double line on the drawing, Fig. 1. All the machining excepting the inside part was done on a Gisholt-vertical boring mill. The turning of the spherical part was done on a large Bouhey lathe of French manufacture, of a type that can be found in any large machine shop.

To machine the spherical surface the tool block and top carriage was removed and replaced by a 24-in. circular milling attachment on which was fixed a large

toolholder with the proper kind of turning tool affixed thereto. The saddle and cross-slide of the lathe were set and fixed in such a position as to make the center

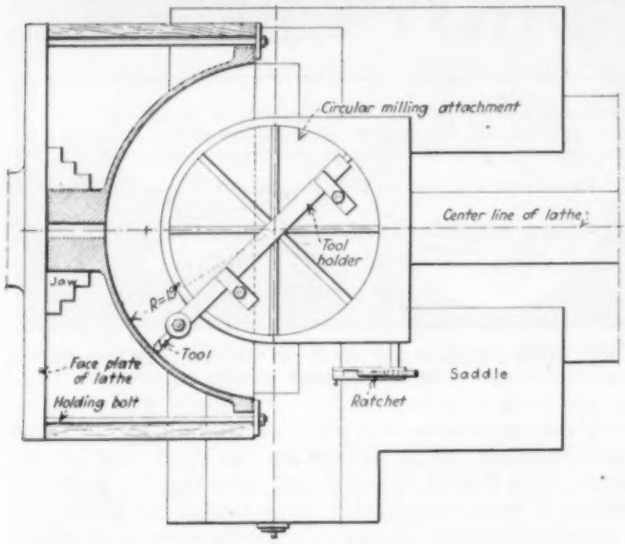


FIG. 1. OUTLINE OF CASTING TO BE MACHINED

of the circular milling attachment agree with the center of the spherical part to be turned. The set-up is shown in Fig. 2.

In order to obtain an automatic feed the handwheel of the milling attachment was replaced by a ratchet, to the handle of which a light chain was attached, the chain being carried over two pulleys fixed on the over-

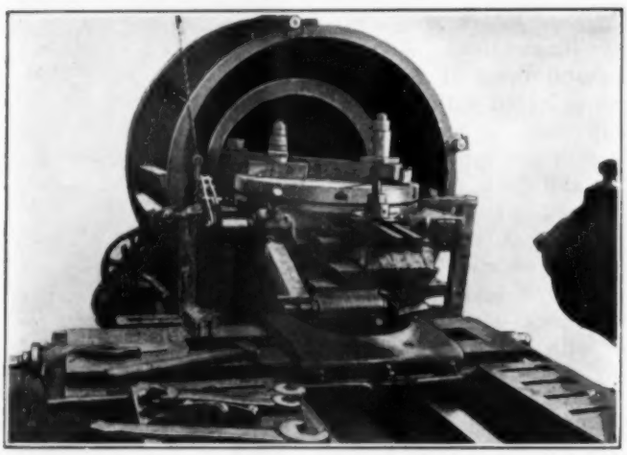


FIG. 2. THE SET-UP IN THE LATHE

head structure and the outer end fixed to an eccentric mounted on a shaft projecting from the headstock.

The drawing and photograph give a good idea of the arrangement. The results obtained were satisfactory in every way.

Emergency Repair on a Large Extractor

BY ELIAS J. PARKS

I was recently called into a dye house one Sunday morning to see what could be done with a large steam extractor. The ball bearing base under the basket shaft had been changed a number of times, so the proprietor had ordered a special one made and when the time came to put it in, the shaft was about $\frac{3}{4}$ in. higher than the connecting rod of the engine; which was mounted above the extractor. As this company was working on special contract work the machine could not be stopped for any length of time, and to send the basket and shaft to a machine shop would have meant a big job, as we could not get it out of the shop without knocking out some of the bricks around the door to let the basket pass.

The extractor basket was 6 ft. in diameter, by 2 ft. deep and the shaft $2\frac{1}{16}$ in. in diameter, if I remember correctly. I decided to try and shoulder the shaft down as required. I built two very strong horses, fastened them to gether and put a piece of $\frac{1}{2}$ x 2 x 6-in. flat steel on top of each horse in the center. These I countersunk for ball bearings and then with a chain block I lifted the basket up into place on the horses where it rested on ball bearings and turned freely.

I went to a friend in a garage nearby and borrowed a cutting-off tool and a small motor. I bolted a block of wood to the side of one of the horses to hold the tool level and clamped the cutting-off tool in position. I passed a rope from the motor pulley around the basket, turned on the juice and the "lathe" was in operation. The cutting-off tool was $\frac{1}{4}$ in. wide so I made three cuts from $2\frac{1}{16}$ in. down to 1 in., feeding the tool by tapping the back end with a hammer.

At first I had some trouble from the tool chattering and digging into the shaft but this I overcame and at three o'clock that afternoon the machine was running on test.

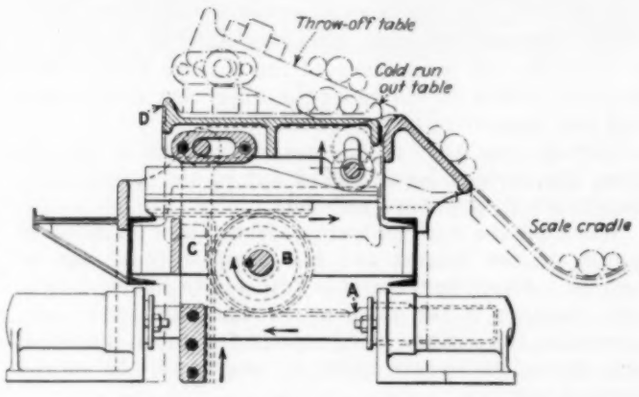
Throw-Off Table for Rolling Mills

BY A. A. RACKOFF

The illustration herewith shows a throw-off table designed by the writer for use in rolling mills working on merchant bars.

In ordinary mill practice the bars, after reaching the cold run-out table, are thrown off and into the scale cradle by hand, requiring the work of two laborers. With the device shown this labor is eliminated, as the operation is by hydraulic power controlled from the same pulpit by the operator of the run-out table.

The piston rod *A* has a rack in the top, meshing into the gear wheel *B* which in turn meshes into a rack on the vertical lifting member *C*. With the piston moving in the direction of the arrow, the lifting member is



THROW-OFF TABLE FOR ROLLING MILLS

raised carrying with it one side of the hinged table *D* as shown by the dotted lines at the top. As the table is tilted, the bars roll off and drop into the scale cradle as shown by the dotted lines at the right.

Improved Parallel Clamps

By Charles H. Willey

The sketches show how a toolmaker in our shop has improved the old-style plain parallel jaw clamps by making the jaws heavier and machining a shoulder on the

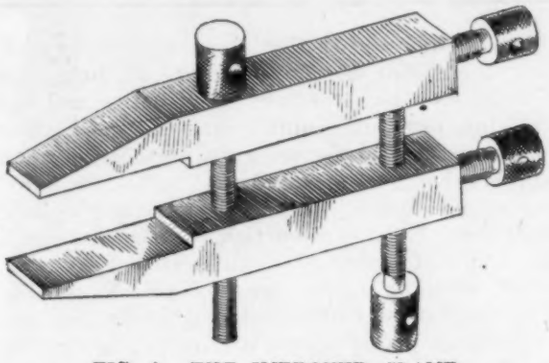


FIG. 1. THE IMPROVED CLAMP

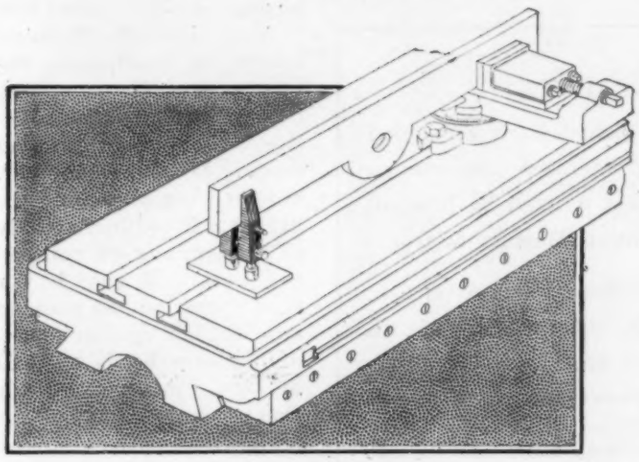


FIG. 2. SHOWING USE OF THE IMPROVED CLAMP

inside of each jaw, and also fitting adjustment screws in the back end of each jaw. The clamps can be used for any regular work for which the ordinary clamp is adapted, and in addition have many advantages that will be obvious to the experienced mechanic.

Should Jigs and Fixtures Be Designed?

By Ernest C. Allen

On page 289 of the *American Machinist* John Mark May furthers the discussion of "Should Jigs and Fixtures Be Designed?" It is gratifying to see that this subject is attracting more than passing interest. To my mind it is immensely important, but despite the fact that I have studied the question for years, I have never been able to reach any satisfactory or lasting conclusion. Figures to sustain any opinion of the matter are practically impossible to obtain. Only by taking two factories, identical in product, size, wage scale and personnel, one operating with, and one without a tool design department could conclusive figures be obtained. Other comparisons always contain abstract facts or elements of executive favor, and although they may be very convincing, they are never conclusive.

In my own experience I have seen tool design departments lumbering along in such ponderous, inaccurate blundering fashion that it seemed a crime to let them exist. I have on the other hand, seen tool design departments which gave every indication of being a paying investment to their factories. The difference in the two was in the way the draftsmen worked. In the former there was too much theorizing, contemplating this and that design and taking too long to do the job. I have seen an entire day's work expended on drawings of such simple things as reamers, simply because of endless and unnecessary comparison of ideas by the draftsmen and useless interference on the part of the checker or department head. In the latter type the draftsmen work; they are enabled to do so by a department system, shorn of all unessentials; instructions to men given in the briefest possible manner; checkers not allowed to tamper with drawings except to hold them within certain pre-arranged standards; no arguments over matters of mere opinion and a strict accounting kept of the time spent upon each drawing.

In addition to the above, I have seen tool rooms which would be helpless without drawings, and still others where draftsmen and drawings would be a positive detriment. Innumerable conditions argue for and against tool drawings. It is manifestly more difficult to build without drawings a box jig for a large, complicated piece requiring an elaborate pattern, than to build a blanking die to a sample of the piece to be made. On the other hand, it is often far easier to build small jigs around the sample, fitting each dimension to the piece than to follow blindly the dimensions on a drawing. The greatest controlling feature, however, seems to lie in the size of the shop. In a small shop everyone knows everyone else. All the processes, the likes and dislikes of the foreman applying them, are more or less perfectly known to the toolroom foreman and even to the toolmaker himself. A toolmaker building a die knows not only the details of the piece to be made, its use, the accuracy and finish required, but he also has access for trying out purposes, to the press where the die is to be used.

In the large shop, like the large city, intimate contact is lost. The toolroom foreman rarely sees what is going on outside his department—the toolmaker never does. Intimate knowledge of the shop's processes becomes restricted to their respective specialists, and tools must be made according to the desires of those using them. What the toolroom then wants and what it must have is definite instructions for its work. Hence, the need of drawings.

A more abstract but still important condition which makes tool drawings necessary in a large shop is the problem of control. With a toolroom employing a hundred men, it becomes impossible to deliver instructions or observe their fulfillment by the old "cut and try" methods. Blueprints are ideal under such conditions as an instrument of control, for not only the toolroom foreman but higher executives can go over and supervise work laid out in blueprint form, when it would be impossible by any other method.

On the whole, tool design departments are expensive, inefficient, blundering things but indispensible where works become too big for a one-man personal supervision. For instance: Let us say a new automobile motor has passed the experimental stage and is given to the superintendent to put into production. The jigs, fixtures, gages, etc., required for such a task are literally numbered by the thousand. Imagine if you can the confusion, resulting from an attempt to plan, lay out the details and convey working instructions to the mechanics by word of mouth only for a job of such a size.

IN THIS ISSUE

THE author of our first article, E. Jullien, describes the system that he installed at the works of Messrs. A. Savy Jeanjean et Cie, Courbevoie, France. The product is special machinery for manufacturing such commodities as chocolate, biscuits and soap. More than one hundred types of machines are manufactured, so that systematizing must have offered a problem of considerable size. The article explains the methods and provides samples of the printed forms used in the control system.

Hunter, in a railroad article, page 894, reminds us that there is something to do to air motors beside run them. He emphasizes the point that they should be kept as close as possible to the condition which will enable them to deliver maximum power. It is easy to see, of course, that keeping motors in perfect repair is a matter of economy and it is equally easy to see how such tools, after grilling performances, may be shoved back into the tool-room without receiving proper attention. The article advocates running tests on new motors to obtain performance standards and frequent tests thereafter to determine whether or not they need repair. Testing methods and testing devices that are in use in the C. & A. shops at Bloomington and the Beech Grove shops of the Big Four at Indianapolis are described.

The tenth installment of DeLeeuw's series on metal cutting tools, page 897, takes up special forms of milling cutters, such as gear cutters, finishing, stocking and duplex cutters, and various types of hobs. This installment is a valuable section of the series.

Colvin takes up a fairly big subject this week in "The Foreman and His Job," page 903. What he says deals with the advisability of frequently changing the worker from one operation to another. There would be few who would advise applying such a system to all operations, and no doubt there are shops where the idea would not even need to be considered. But just as surely there are operations on which a man should not be kept continuously, where a rotation of operators would raise the average production and benefit those engaged thereon.

Dowd and Curtis are still pounding away on drill jig design and we venture that the many readers of this series do not find any fault because of that. General principles of design that are used in jigs and fixtures for milling, profiling, splining and other operations are necessarily used in the design of drill jigs, so that a comprehensive treatment is bound to be a lengthy one. The specific subjects treated this week are V-block and leaf jig design, leaf construction, clamps in the leaf, leaf stops and leaf locks. The illustrations are well and carefully thought out and are plentiful. Page 905.

The heavy-duty, ball-bearing, radial drilling machine that has been placed on the market by the Carlton Machine Tool Co., Cincinnati, is described in this issue, beginning on page 908.

We classified Hunter's article on pneumatic motors as a railroad article, because it deals with practice as found in railroad shops. We have another, however, beginning on page 911, that is confined strictly to a treatment of railroad equipment. It goes in for such operations as pouring hub liners in driving boxes, milling crossheads and rod brasses, the use of air clamps and a method of placing locomotives to save room. The data were obtained in a New England shop of the Boston & Maine at North Billerica, Mass.

We shall let A. B. Cox speak for his own article, "Slip of Involute Gear Teeth," page 913: "The intent of these data and curves is to show that the efficiency of gears can be increased and the wear decreased by choosing large numbers of teeth; that the use of gears of shorter addendum or greater obliquity of the line of action reduces slip and increases the percentage of rolling contact; and that the gain in efficiency from increasing the angle of obliquity is offset by the increased friction losses in the bearings in proportion as the angle increases."

This is the convention season. Reports on three are furnished in our news section (not published in the European edition). They are those of the triple convention of the Supply and Machinery Dealers and Manufacturers Associations, the National Association of Manufacturers and the Taylor Society. Also, there are in the editorial section, abstracts of several of the addresses made before the National Foreign Trade Convention held recently in Cleveland.

Coming Features

Next week's issue will furnish some very good advice on how the shop manager can use an appraisal. The article was written by Morgan G. Farrell, of Miller, Franklin, Bassett & Co.

The magnetic chuck of the Persons-Arter Co., of Worcester, Mass., is the subject of the eighth installment of Ellsworth Sheldon's Magnetic Chuck series, to be in the next issue.

The manufacture of oil well tools has become of greater magnitude than many realize. We have allotted six pages of the next number to a story by Colvin on this subject.

There will be an "economy" article by Stanley; "Saving Material in a Railroad Shop" is the title.

Tool Engineering will, of course, be a part of the issue. The sixth installment continues with drill jig design.

EDITORIALS

Cutting Down Government Overhead

ONE of the big jobs in President Harding's proposal to put more business in government is the reorganization of government departments. Various investigators have pointed out the overlapping of functions that exists in the present system which has been handed down to us by our great-grandfathers. Mr. Hoover has bumped into it hard in his endeavors to make the Department of Commerce a real aid to business.

Everyone admits the need for a regrouping of administrative functions, but the difficulty is to get action. A new administration with the country behind it can do much in its first month in office to change long-established customs. The forces of obstruction are temporarily in disorder and their defeat is relatively simple.

But once the dust of the disturbance has settled and the standpatters have had a chance to look around and get their bearings, the opportunity for further innovations is but fleeting at best. It is no more than human nature for the head of the department that will lose by a change to object, and he will have many earnest supporters who are more or less personally interested. At this stage of the game, therefore, only a thoroughly aroused public opinion can force through desirable and even necessary changes.

The McCormick Bill contains the recommendations of the United States Bureau of Efficiency. Other bills looking to the same ends have been introduced. Don't forget, however, that bills are quite likely to die in committee rooms if there is not a concerted demand for their passage. Make government reorganization a live subject by discussing it wherever you have a chance. If enough people get to talking and thinking about it the echoes are sure to reach Washington and then, and not until then, can action be expected of the powers that sit in Congress assembled.

More About the Department of Commerce

HERBERT HOOVER has taken another important step toward making the Department of Commerce of real service to business by appointing, as his personal assistant, F. M. Feiker, vice-president of the McGraw-Hill Co., Inc. Besides having back of him an abundance of the right kind of experience, Mr. Feiker knows where to go for information, how to get it, and how to use it, several points in his make-up that indicate an ability suited to the job. His work of organizing and developing those branches of the Department of Commerce which relate directly to commerce and industry, will have to do largely with statistics and research.

Mr. Feiker, in a statement of the purposes of his new work, said: "I am keenly interested in Mr. Hoover's broad plans for the development of the Department of Commerce as an aid to industry. Mr. Hoover is particularly anxious to learn from industry itself in what way this department can expand so as to be of service to the business men of the country. I hope to be able to assist Mr. Hoover in the development of the statistical and research branches of the Government in such a way as to provide information and help for the needs of the average business man and the small manufacturer. Our great industries have learned the value of and have established statistical and research bureaus, but the average business man has neither the time, nor the opportunity, nor the capital, to make the necessary investment individually to make this possible. The Government's functions in the collection of fundamental data and trade information can be put to his service in a definite and practical way."

Though covering only a part of the scope of the department, the field outlined by Mr. Feiker is a big one and offers opportunity for some hard and very necessary work. A good man has been selected to do it.

Good News from Governor Harding of the Federal Reserve Bank

THE steady rise in the reserve percentages of the Federal Reserve banks has not been without significance to careful observers. It has resulted, as predicted, in a reduction of certain discount rates and consequently in a better outlook for general business.

In a recent address Governor Harding of the Federal Reserve Board said, among other things, "The Federal Reserve banks are today in a very strong position, with an average percentage of gold and lawful money against deposits and note issues of fifty-five per cent, as compared with forty-two per cent a year ago, the reserves are higher than they have been since the fall of 1918 before the flotation of the Fourth Liberty Loan. They are able now safely to take part in a movement to stimulate business, with a view to liquidating frozen credits, that they have not been in a position to do heretofore.

"The time has come for renewed courage and confidence. We are entering now the springtime, are upon the threshold of the production season. Frozen credits, which must be thawed out gradually must be taken care of. Many men have liquidated down to the bone. They should be encouraged to build themselves up. We are reaching every day a safer basis on which to do business. There can be no question that the present maladjustment is temporary. The economic forces are seeking to reconcile themselves and they will do so."

Up to the present time there have been many voices calling to the business man and the manufacturer to start something, but nothing has been said about the very practical matter of procuring the wherewithal. The bankers have come in for their share of criticism for not extending further credit and perhaps this was justified in some cases. We do not care to enter into a justification of banking policies, there are other and better agencies for doing that. But now that the banks are beginning to feel equal to a move to stimulate business, we cannot help but be encouraged no matter how gloomy things may look in our own particular sphere of action. The return to prosperity may be slow but it is none the less sure.

Shop Equipment News

Niagara Horizontal Duplex Double-Seaming Machine

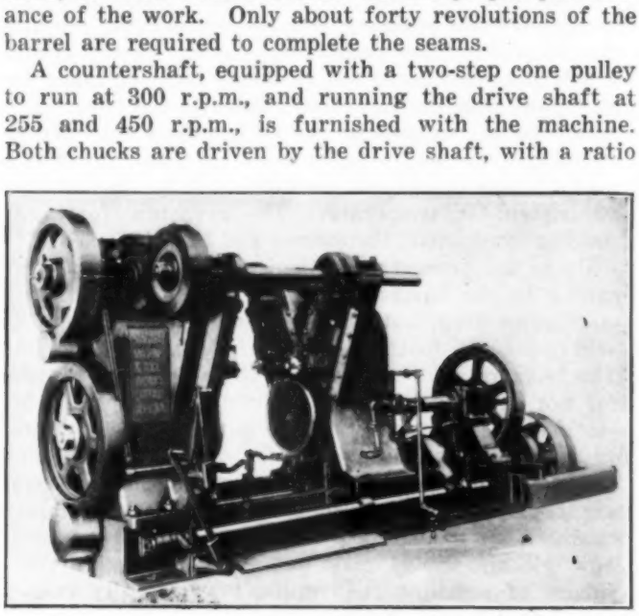
The Niagara Machine and Tool Works, Buffalo, N. Y., has recently placed on the market a machine, shown in the accompanying illustration, for double-seaming simultaneously both ends of sheet-steel barrels or drums. The machine is handled by only one man. It is capable of seaming barrels from 18 to 36 in. in diameter and from 20 to 45 in. in height and made of No. 12 gage or lighter steel.

The right-hand column is arranged to slide horizontally on the bed and is moved forward or backward by means of a hydraulic cylinder controlled by a three-way valve. Approximately 50 lb. per square inch water pressure is sufficient to produce the required pressure on the barrel heads. The main gears are made of steel and are machine cut. The seaming rolls are high-grade tool steel and are run on large, bronze-bushed bearings. All movable parts are well guarded.

When operating the machine, the barrel, with the heads in place ready for seaming, is rolled in on runways onto the horizontal bars. The barrel is located on the supports by stops, and is raised in line with the chucks by means of a treadle. The column is then moved into position by the hydraulic cylinder, which is operated by means of a hand lever. The pressure thus exerted clamps the barrel between the two chucks, forces the heads into their proper position, and holds the body while the seaming operation is being performed.

The seaming operation is started by means of a hand lever which releases a positive instantaneous clutch and sets two camshafts into motion. The curling rolls are automatically brought down to the work, and curl the seams. These rolls then recede, and the flattening or finishing rolls move into position and finish the seams. The machine makes a predetermined number of revolutions, to allow sufficient time for the proper performance of the work. Only about forty revolutions of the barrel are required to complete the seams.

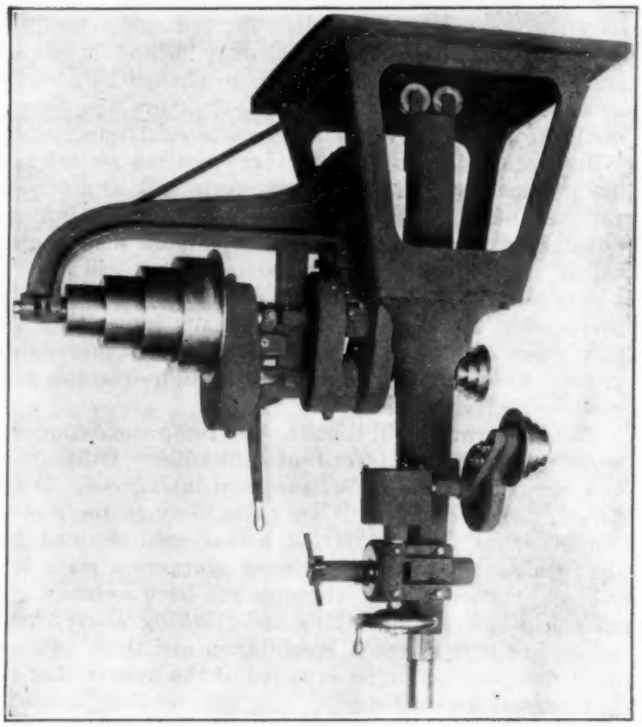
A countershaft, equipped with a two-step cone pulley to run at 300 r.p.m., and running the drive shaft at 255 and 450 r.p.m., is furnished with the machine. Both chucks are driven by the drive shaft, with a ratio of 3:1. Twenty-five horsepower is required to operate the machine. The motor can be direct-connected. The machine is 93 in. high, 62 in. from front to back and 211 in. from right to left. Equipped with one set of rolls, it weighs approximately 21,000 lb.



NIAGARA DUPLEX DOUBLE-SEAMING MACHINE

Reed-Prentice Suspended Drilling Machine

The Reed-Prentice Co., 53 Franklin St., Boston 9, Mass., has recently placed on the market the suspended type of drilling machine shown in the illustration. The machine is suspended from the ceiling and fastened thereto, or to overhead timbers, by screws or bolts. There is nothing on the machine to interfere with work that may be brought under it. Owing to the construction of the frame, no truss rods are needed to support the machine. The spindle is counterbalanced, has hand and power feed, a quick-return movement, and three changes of feed. The operating mechanism resembles that found on the usual type of upright drilling machine. The work can be held in any manner desired, because of the absence of the machine table.



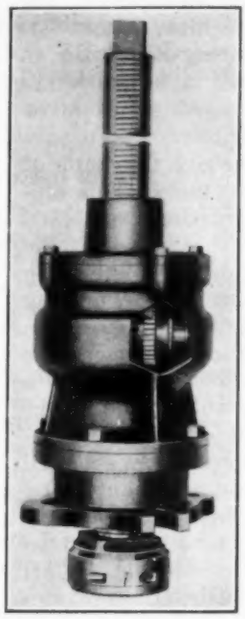
REED-PRENTICE SUSPENDED DRILLING MACHINE

Specifications: Spindle; feed, 19 in.; diameter, 2 in.; taper hole No. 4 Morse. Countershaft; tight and loose pulleys, 14x4 in.; speed, 200 r.p.m. Distance from ceiling to lower end of raised spindle, 68 in. Ceiling space required to fasten frame; 36 x 36 in. Weight; net, 1,800 lb.; boxed, 2,200 lb. Export box, 54 cu.ft.

Change gears can be furnished to give any required feed. The handle for operating the back gears can be made any desired length, so as to extend to about the same position as the handwheel on the feed and to be easily reached by the operator. The machine is capable of drilling holes up to 2 in. in diameter. A countershaft is furnished.

Van Dresser Cylinder-Reboring Tool

The illustration shows a device recently placed on the market by the International Purchasing and Engineering Co., 506 McKerchey Building, 2631 Woodward Ave., Detroit, Mich., for the purpose of reboring the cylinders of automotive engines. The device is known as the Van Dresser cylinder-reboring tool and consists essentially of a cutter or reamer, a driving and a feeding mechanism for it, a housing and a base which can be fastened directly to the top of the cylinder to be machined.



VAN DRESSER CYLINDER REBORING TOOL

The size of the reamer is adjustable, so as to make it applicable to cylinders of different diameters. The high-speed steel blades are ground helically, and can be adjusted in unison from the lower end of the reamer head without removing the head from the feed bar.

The base of the housing is said to be adaptable to any motor, although special bases can be furnished to fit any particular motor. A centering plug is applied in order to properly fit the base of the machine to the motor cylinder. The spindle bar is hardened and ground and has a bearing 9¼ in. long in the housing. There are no threads upon it, although rack teeth are cut in one side. Due to the long bearing of the spindle, and to the clamping of the device upon the cylinder block, it is said the hole is bored true throughout its entire depth.

The device may be operated by hand or run by a drill press. In the latter case, the feeding mechanism of the drilling machine may be used, after disengaging the feed of the reboring tool. A floating driving socket is provided to automatically take care of any misalignment of the drill spindle with the tool itself. An extension driving bar may be provided for use with drilling machines. Because of the fact that the feeding mechanism is continuously engaged, it is stated that a smooth finish can be obtained in a cylinder even though the spindle be turned by hand.

The motor cylinders on many cars may be rebored with the motor in place in the chassis. The necessary precautions must, of course, be taken to prevent chips from reaching the bearings of the motor. The device is made in seven sizes, to bore cylinders from 2⅞ to 4½ in. in diameter, each size being adaptable to cylinders varying in size ⅜ to ¾ of an inch.

Fischer Oil-Grooving Machine No. 2

The Fischer Machine Co., 310 North 11th St., Philadelphia, Pa., has recently placed on the market the oil-grooving machine shown in the accompanying illustration, and intended for the grooving of the internal surfaces of bearings up to 15 in. in diameter and 15 in. in length. The machine is said to combine the standard features of construction of engine lathes and crank shapers.

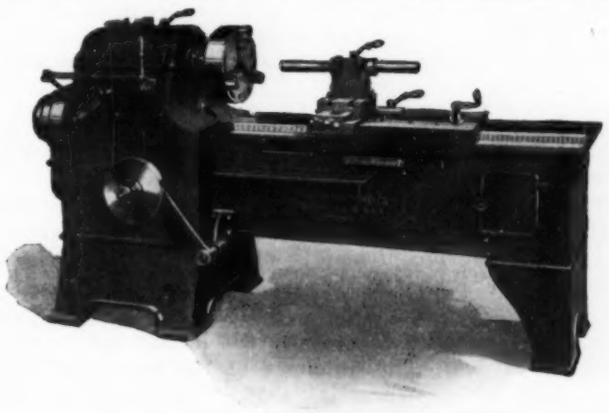
The bearing in which the oil grooves are to be cut is mounted on a revolving chuck or faceplate, and the boring bar is carried by a block mounted on a reciprocating slide. By different combinations of movements of the tool and work, oil grooves of various types can be produced. By holding the work stationary and reciprocating the toolslide, a straight oil groove may be cut parallel with the axis of the bearing; but with the toolslide stationary and the work revolving, a circular groove may be cut in a plane perpendicular to the axis. By operating both movements simultaneously, grooves may be cut at any angle to the axis of the bearing.

The machine is driven by cone pulleys from a countershaft, and it is started by engaging a friction clutch on the drive shaft. The work-holding spindle can be clamped in position when it is so desired, or a positive clutch can be used to index the work a fraction of a revolution.

In order to cut helical grooves of different pitch, change gears are provided, so as to vary the speed ratio between the spindle and the carriage. The length of stroke is adjusted by means of a wrench, and a scale underneath the carriage indicates this length, to aid in setting the stroke. To provide for varying the diameter on which the tool is cutting, a cross-slide on the carriage is operated by means of a screw and a ball crank. The position of the tool on the carriage may be adjusted longitudinally by means of a crank, being clamped to the reciprocating carriage after it has been properly positioned.

In order to cut grooves that are symmetrical, it is necessary to have some means of compensating for the errors which would result from the angularity of the connecting rod which transmits the reciprocating motion to the carriage. This is accomplished by a compensating mechanism incorporated in the drive, so that the tool has the same motion as would result from the use of a connecting rod of infinite length.

The machine is equipped with a relieving and taper attachment, to provide for cutting oil grooves in tapered bearings as well as in straight ones, and also for withdrawing the cutting tool at different points in the revolution of the crank, when it is desired to modify the form of grooves that would be cut by the machine. In this way, it is possible to cut grooves in such forms as a cross, a half circle, or a right- or left-hand helix of varying pitch.



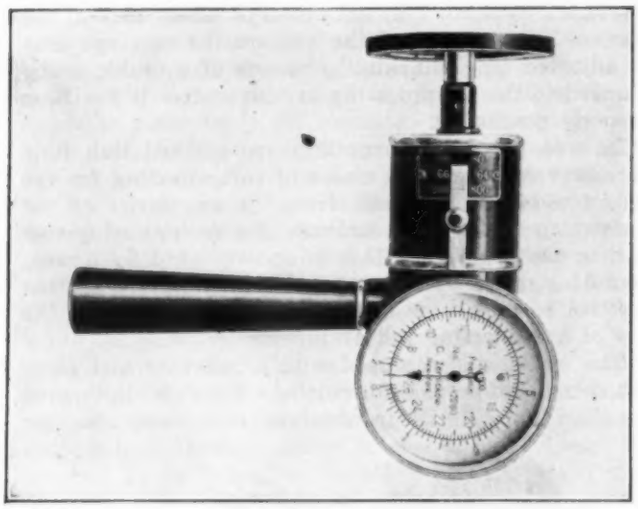
FISCHER OIL-GROOVING MACHINE NO. 2

Specifications: Hole in spindle, through, 1¾ in.; taper, No. 3 Morse. Thread on spindle; diameter, 3 in.; pitch, 6 per inch. Spindle speeds, 14, 21, 32, 48, 73 and 111 r.p.m. Maximum length of groove cut, 15 in. Revolutions of spindle to one of crank, 1, 2, 3, 4, 5 or 6. Swing over bed, 19 in. Speed of countershaft, 200 r.p.m. Horsepower required, 2. Height above floor; spindle, 3 ft. 8 in.; ways, 2 ft. 10½ in. Floor space, 8 ft. 8 in. x 2 ft. 8 in. Weight; net, 3,000 lb.; crated, 3,380 lb.; boxed, 3,600 lb. Export box, 9 x 3 ft. x 5 ft. 2 in.

O-Z Cutmeter

The device shown in the illustration, known as the O-Z cutmeter, has recently been placed on the market by O. Zernickow, 15 Park Row, New York, N. Y. It is intended for determining the cutting speed of machine tools of all types. It may also be used for such purposes as ascertaining the speed of rolls in paper mills and the linear speed of belts and ropes.

When in operation the device is held by means of the handle, and the small wheel is placed in contact with the moving works or machine table, the surface speed being shown directly on the dial. The meter operates on the governor principle, and it is said that its accuracy is not affected by changes in temperature, by moisture or by the presence of magnetic fields. A damping mechanism is incorporated, so as to prevent vibration of the indicating hand, the mechanism serving to neutralize shocks and vibration which would be transmitted from the machine or work being tested. When fitted with the pointer provided for the purpose, the device may be used to indicate revolutions per minute. It is not necessary to use a watch to time the period



O-Z CUTMETER

of test, nor to calculate the speed. The device is said to operate equally well in any position.

The housing is of an aluminum alloy, black enameled with nickle-plated trimming. The handle is removable, so that the instrument may be placed in the case which is provided. By means of the three separate ranges, the device may be used to indicate revolutions per minute from 30 to 1,200 and speeds in feet per minute from 20 to 800. The diameter of the dial is 2⅜ in., while that of the wheel is 2½ in. The length of the instrument is 5¾ in., and its net weight ¾ lb.

Cincinnati Hy-Speed Machine Co. Drilling Machine

The Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio, has recently developed and placed on the market a line of drilling machines of the type shown in Fig. 1, and sold under the name of "Hy-Speed."

Among the features of the machine are the single-pulley, direct, overhead drive and the dry-plate clutch operating in connection with the externally clamping, adjustable, air-cooled brake. By means of a single handle directly in front of the operator, the machine can be instantly started and stopped, adding considerable speed and convenience to the operation of the machine. The elevating mechanism of the table is so arranged as to allow drills and taps to pass through the center of the table. This construction, combined with the use of the quick-releasing chuck, allows tapping without reversal. The spindle speeds are controlled by a handle on the side of the column. An automatic power feed and an automatic tapping attachment can be arranged on any spindle. Unit construction is embodied in the machine. The entire clutch, brake and the initial driving gear form a separate unit that is set into the top bracket of the machine. Fig. 2 gives a view of the driving pulley and mechanism. For accessibility, the counterweight of the spindle is hung on the outside of the machine.

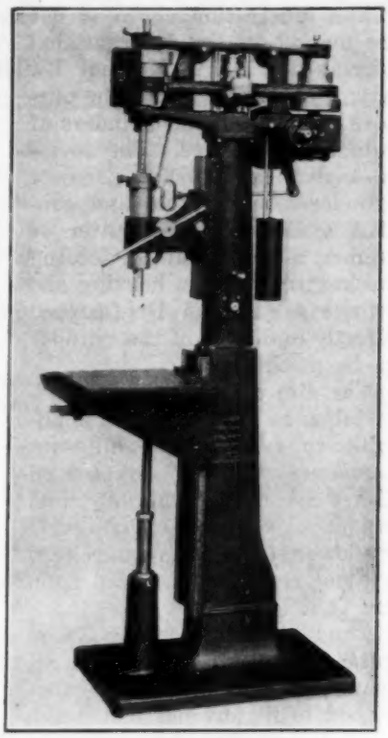


FIG. 1. "HY-SPEED" DRILLING MACHINE

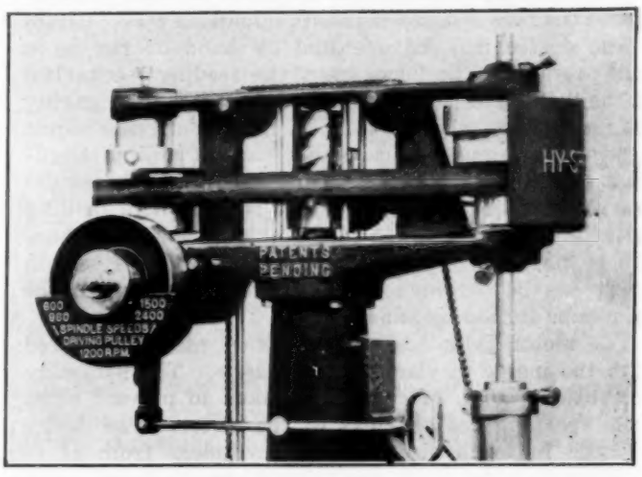


FIG. 2. DRIVE MECHANISM ON CINCINNATI "HY-SPEED" DRILLING MACHINE

The narrow-faced idler pulley is carried directly on the belt shifters and, moving intermittently with the shifters, helps lead the belt from one step to another. All pulleys are made of aluminum. The pump and tank form a separate unit, attached to the base of the machine and arranged for ease in cleaning. S. K. F. ball bearings are used throughout the entire machine.

The machine is built in various types for either floor or bench use, with a single speed if desired, or a belted motor drive, an automatic power feed or an automatic tapping attachment.

Abstracts of Foreign Trade Convention Addresses

What Prominent Business Men, Financiers and Legislators Think of Present Industrial Conditions—Some Thoughts on the Future

In these abstracts of several of the addresses delivered before the Eighth Annal Convention of the National Foreign Trade Convention, held at Cleveland, Ohio, the field has been covered in a broad way, and subjects of genuine interest to all are discussed.

The Effect of Double Taxation on Our Foreign Trade

By Daniel R. Williams
American Chamber of Commerce, Manila

The commanding position achieved by Great Britain in her overseas commerce is due in very large part to the presence of British resident merchants in practically every port and market of the world. The encouragement offered such merchants is evidenced by the fact that today, despite the urgent need of Great Britain for revenue, no tax is imposed upon the local income of British subjects resident abroad. This attitude of co-operation and helpful assistance assumed by Great Britain toward her nationals engaged in foreign business is followed by practically all the great trading nations of the world. Our Government, however, with its expensive and elaborate foreign service organization, has failed utterly to recognize the essential rôle played by its foreign merchants, and the imperative need for safeguarding their interests. Instead of extending help and protection to them, or offering encouragement to those who might be induced to venture their capital and efforts abroad, it burdens them in such manner as to render success doubtful if not impossible. No American can establish a business in any foreign country today without facing the fact that the disadvantage worked on him by this income tax requirement may nullify his efforts and leave him at the mercy of his more fortunate rivals. Those who have actually sat in this foreign trade game realize that the odds are already great enough against them without stacking the cards in favor of their more experienced opponents. An even break, with a fighting chance for success, is the least our pioneer trade missionaries have a right to expect in the struggle they are making to create and develop new markets for American products. Any person who has striven for success in sport or business will know how killing a handicap of this sort may prove. It is certainly anomalous for our Government to insist upon the one hand that the needs and prestige of the United States require that Americans engage in foreign service and undertake foreign ventures, and at the same time voluntarily start them in the race with this tax burden upon their backs. To expect them to win in such case against competitors trained to the minute, and carrying no weight, is to ask the impossible.

The situation thus painted cannot be dismissed as mere special pleading. The evidence which comes from every quarter of the globe as to the discrimination worked by such tax against Americans and to the advantage of their competitors is too unanimous and too overwhelming to be questioned or minimized.

Another fact to be emphasized, and upon which some confusion exists, is that in seeking exemption from this tax there is no effort or purpose on the part of our nationals abroad to escape a legitimate obligation. The protest is not against being taxed *per se*, but against being compelled to pay this particular tax when others, with whom we are competing for a proper place in world commerce, suffer no such burden.

A further important consideration apparently forgotten or overlooked by our legislators is that the incidence of a tax applied within the United States is or may be altogether different from that of the same tax when sought to be applied beyond our borders. In the former case such tax, whether collected as customs dues or otherwise, is uniformly added by the persons affected to the selling price of their products, whereas such a recoupment on the part of non-resident Americans may prove utterly impossible. It is *prima facie* that our foreign merchants must meet the prices of their competitors or go out of business. Where these prices are fixed, however, by persons who pay no such tax but who handle identical products, the consequences are apparent. The American is compelled, if he does business at all, to liquidate this additional demand upon him out of profits. Argument is superfluous to convince that this cannot be done for any length of time, as profits equivalent to this exorbitant tax are not possible in modern competitive business. As the law now stands an income of $100,000 must pay a tax of $31,190, while upon an income of $600,000 the Government takes $375,190. Payment of such enormous amounts as these is only possible where the burden applied uniformly upon all persons engaged in the same business or calling. It is not possible to our resident merchants abroad, whose competitors are exempt from any such payment.

The logical effect of this tax, if continued, must be to drive our citizens out of foreign communities where they cannot compete on even terms, or to give them a substantial inducement to acquire a citizenship less burdensome than ours. These consequences, through the law of diminishing returns, would eventually defeat the purposes of the act—without, however, repairing the damage already accomplished. On the other hand, the suggested exemption will not only tend to greatly stimulate our foreign trade, but will, through the increased revenue derived from profits realized by domestic concerns interested in such trade, much more than compensate the Government for any loss suffered from the other source.

Practical Developments in Edge Law Banking

By Philip B. Kennedy
Vice-president, First Federal Foreign Banking Association

Owing to the fact that I have been associated with the the management of an Edge Law bank since the middle of last June I have been asked to tell how it works in practice. Present experience to draw upon is necessarily limited because there are only two Edge Law banks actually in operation, one of which has had nearly a year's experience and the other several months' experience.

Existing experience has not fully tried out the possibilities of the Edge Law because it has applied to only one of two kinds of financing which may be done by banks organized under its provisions. Such a bank may do either an acceptance business or a debenture business, but not both. The Federal Reserve Board ruled in its regulations that an Edge Law bank may not have outstanding at the same time both acceptances and debentures except with the approval of the board. Later, when requested by one of the Edge Law Banks for a ruling, the board held that a bank having outstanding acceptances could not issue debentures. This means that there will be two kinds of Edge Law banks. One kind will be an acceptance bank which will issue longer term commercial import and export credits to exporters and importers; the other kind will do a debenture business, which generally speaking means making long time loans to foreign countries. The first kind of Edge Law bank will deal directly with exporters and importers, grant them lines of credit, take their foreign drafts for discount or collection, and do a general international banking business; the second kind of Edge Law bank is not expected, except in unusual instances, to deal with individual importers or exporters, but is counted upon to improve general business conditions by making large capital loans abroad. It will therefore be seen that the two different kinds of Edge Law banks have distinct fields and cannot be said to compete with one another.

The proposed hundred million dollar corporation, according to public announcement, is to be of the debenture type.

Since it has not yet emerged from the promotion stage no experience has thus far been had with debenture financing.

The debenture is a new type of security in the American investment market, and would have to be made generally known before regular sales could be counted upon. Since a new type of security would have to be popularized there would be need, no doubt, for a large-scale undertaking. The acceptance market, on the other hand, has been effectively developed in this country for the past five years.

Although Edge banks ought to take energetic steps to help finance the oversea shipments of our great staples this is not their only business. They also offer credit facilities to the individual shipper. This does not mean that they are trying to take manufacturers or export merchants away from their regular deposit banks. Such relations are not disturbed because Edge banks do not receive deposits except such as are incidental to foreign transactions. The Edge bank does not predicate its accommodation to an exporter on the basis of his deposit balance. It asks for no deposit account, but extends its special foreign facilities at net cost.

Confidence at Home and Credit Abroad

By U. S. Senator Walter E. Edge, New Jersey

To maintain production at normal and to stimulate it to the full potentiality of our great development under stress of war we must, of course, have markets—domestic markets to maintain it at normal and foreign markets to absorb the surplus output and occasion a demand for more products. So the pressing need of the moment is the providing of markets, at home and throughout the world. Uncle Sam now is suffering from "complications." The real ill is a lack of markets, caused at home by a "buyers' strike" and abroad by lack of cash and non-cultivation of credit. The first medicine for the buyers' strike must be confidence, and for the foreign situation it must be the provision of credit and the transmutation of that credit into dollars to pay to American producers and American labor and American agriculture.

The foundation of all business is confidence, and credit is the cornerstone. There can be no confidence among the people while uncertainty prevails as to the nature of the remedies to be provided for the present uncertainty and apprehension. And credit is apt to be mighty tight till confidence is established. Nor can confidence be firmly and solidly established on a quicksand of theoretical, visionary or artificial legislation. Practical, businesslike legislation need not be devoid of ideals simply because it is practical; but practical ideals must not be sacrificed to theoretical ideals that cannot helpfully be put into effect.

Nor will it be necessary to defer the cultivation of world markets till the home market has been created; the two movements well may go forward together. Under the Export Finance Amendment to the Federal Reserve Act expanding the American banking system to international proportions immense credits may be furnished to impoverished foreign purchasers of American goods, these credits being turned into American money for payment to American producers and vendors, with profit to every American involved in the transactions. No legislation is needed for this procedure; it already has been provided. It merely remains for the financial and commercial groups in the United States to take advantage of the opportunity and the procedure.

All these ills—depression in business, depression in production, lack of business for railroads and the merchant marine and consequent unemployment—will be corrected only if we attack the root of the evil, and the only solution to these and other related problems is the securing of a market. The buying power both at home and abroad exists; if abroad it is aided by an extension of credits we can well afford to extend, and they have the security to protect us; and at home by the return of confidence which can only be brought about by a realization that men can develop, can make a reasonable profit on their enterprise and, most important, retain it. We cannot expect to rejuvenate home or domestic enterprise as long as the Government continues a policy of requiring as high as 70 per cent of the profits to be paid to the Government; the tax system must be revised so that the burden will be more equally distributed and in the long run the rich will pay the bill just the same, because they will be encouraged to do big things, and thus employ labor, increase production and radiate that happiness and contentment necessary to insure general prosperity.

Value of Long Credits to the Exporting Manufacturer

By George R. Meyercord
President, Illinois Manufacturers' Association

As I view the Edge Law foreign trade financing machinery, it offers the first step whereby the manufacturer gets some reasonable measure of relief toward creating that highly desirable, stabilized situation whereby his frozen inventory is rendered more liquid.

History will repeat itself in Europe. Countries now struggling bravely to regain their pre-war standing have lost little in natural resources or industrial competency. All they need is time—a little time—to recover. They are solvent. They furnish the most inviting field in the world for foreign trade, for they are in need of American goods. Their supply of machinery for production, agricultural implements, transportation equipment, tools, hardware, electrical supplies and innumerable commodities that can be supplied by our manufacturers, is exhausted or very low. They need above all the raw material or the partly manufactured stocks which can be furnished by this country, and which can fast be turned into money by the industrious millions of war-sick Europeans.

Our manufacturers, our mines and our farmers are willing and anxious to supply European needs. They expanded during the war, and overseas trade is essential to their enlarged capacities. But as they cannot always operate their plants on future promises to pay, no matter how dependable those promises are, they must have behind them some financial organization that temporarily will supply this money while the rich European trade is being garnered.

Every day American manufacturers are being offered profitable European business that they reluctantly are obliged to decline because this country has lacked the foreign trade financial machinery that has been developed so successfully by Great Britain.

The Foreign Trade Financing Corporation through its debentures speaks in American dollars to the American investor, and the American investor need only have faith in the vast capital of the corporation and in its management. Surely it is axiomatic that this faith will follow. It is unthinkable that the management will not be both able and of a superior order.

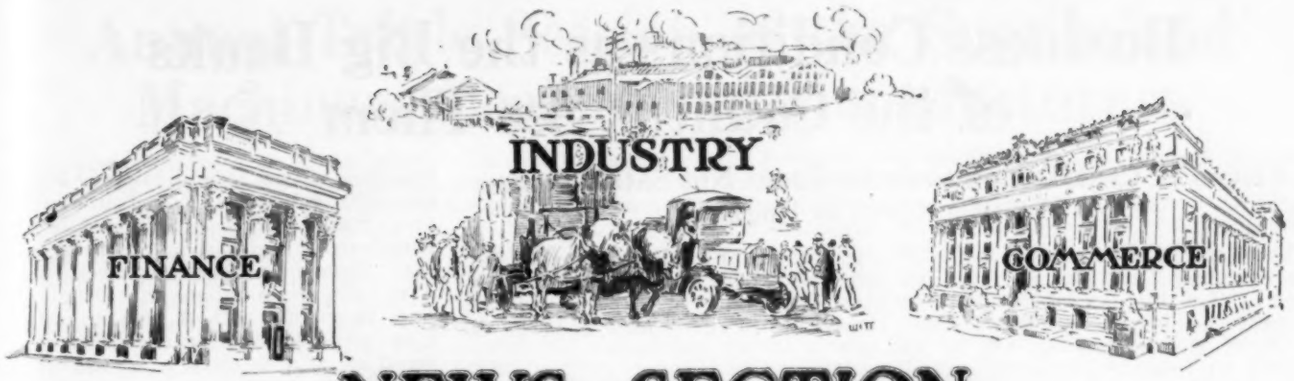
The manufacturer who invests in the stock of the Foreign Trade Financing Corporation will be amply repaid. It will be a profitable investment. It will help every manufacturer and business man in the country. It will solve employment problems and restore the general prosperity to which progressive industry is entitled.

In closing I want to protest most strenuously against the viewpoint so prevalent and now so often expressed to the effect that we must keep down the tariff bars to our own markets. This viewpoint is on the theory that the only way Europe can pay is to flood our markets with goods. We could better afford to give our foreign friends the funds direct with which to rehabilitate themselves.

I submit that it is rank financial heresy to throw a $6 a day man out of a job in this country and substitute a $1 a day man in Europe, which is a starvation wage at best, and expect a saving to accrue out of the dollar that will compensate the American workman for the loss of his $6 a day job.

I submit further that the world's purchasing power has been reduced five-sixths under this plan and the American purchasing power has been reduced six-sixths.

I desire to commend President Harding for his sane attitude on this thought. America's export business will never be built up on a foundation of destruction of its domestic market. I believe that the proper plan is to invest our surplus in foreign securities of the Foreign Trade Financing Corporation now organizing.



NEWS SECTION

Garman Is New President of American Engineers

H. O. Garman, chief engineer and consulting engineer for the Indiana Public Utilities Commission and the Indiana Railroad Commission, was elected president of the American Association of Engineers at its annual meeting held this month at Buffalo, N. Y.

Mr. Garman is prominent in engineering circles in the Middle-West, having been engaged in various engineering enterprises and at one time a professor of engineering at Purdue University.

Other officers elected at the convention were: A. N. Johnson, dean of engineering at Maryland State College, vice-president; A. S. Morris, of the C. & N. W. R.R., second vice-president; E. F. Ayres, W. L. Benham, Garrison Babcock, Morris Bien, G. M. Butler and W. R. McKeen, directors.

Annual Convention of the American Drop Forge Association

Chicago has been selected as the location for the eighth annual convention of the American Drop Forge Association, which meets annually in connection with the Drop Forge Supply Association. The meetings will be held at the Congress Hotel on June 22, 23 and 24. Arrangements have been made for a trip of inspection of the Gary Works of the Illinois Steel Co., and other shop visits will doubtless be arranged for. The preparation of the program is in charge of E. B. Horn, secretary, 6026 Helen Ave., Detroit, Mich.

The preliminary announcement of the program of papers for the meeting includes "Costs," by J. B. Sehl, Billings & Spencer Co.; "Board vs. Steam Hammers," by Edward S. Jordan, Jordan Motor Car Co.; "Electric Furnace Heat Treatment of Dies and Forgings," by E. F. Collins, General Electric Co.; "Twenty-five years of Forging Experience," by E. A. Adams; "Wage Conditions," by Arthur A. Young, International Harvester Co.; "The Future of the Tractor Business," by James M. Irvine, Curtis Publishing Co.; and "Hot Sinking of Drop Forged Dies," by Ralph H. Tyler, the Herbrand Company.

McGraw-Hill Officer to Be Assistant to the Secretary of Commerce

F. M. Feiker, vice-president of the McGraw-Hill Co., of New York, has been appointed Assistant to the Secretary of Commerce. This event is of real significance to advertising and business interests generally. Briefly, Mr. Hoover has divided the bureaus of the Department of Commerce into two parts. Assistant Secretary Huston will supervise the Bureaus of Fisheries, Lighthouses, Navigation, etc. Mr. Hoover

FRED M. FEIKER

will give his personal attention to the Bureau of Foreign Commerce, Standards and Census. Mr. Feiker will directly assist Mr. Hoover in the expansion of these bureaus.

Mr. Feiker is a graduate of the engineering school of Worcester (Mass.) Polytechnic Institute. He was engaged in electrical research work for several years and later served in an advisory capacity with the General Electric Co. He had also been chairman of the editorial board of various engineering publications before joining the McGraw-Hill forces.

The immediate problem is to find out what kind of facts and figures industry needs from the Government by means of a series of conferences with the representative men of industry. Having organized the department to function according to the requirements, the next problem is to devise an adequate system of clearing the collected data back to business. It will be apparent at once that with Mr. Feiker's background of engineering training, viewpoint on the needs of industry, publishing experience and sense of publicity, he will be able to render unusual service.

It is Mr. Hoover's purpose to develop the Department of Commerce so that it will have the same relation to business that the Department of Agriculture now has to the farmer. In other words he feels that its function is to aid industry, not regulate or control it. Considering his intimate knowledge of foreign conditions, his masterful grasp of economic principles, and his present official position, we may take a most optimistic view of the developments in prospect.

Mr. Feiker has been granted a leave of absence from the McGraw-Hill Co.

Material Testers to Convene at Asbury Park

The provisional program for the twenty-fourth annual meeting of the American Society for Testing Materials has been announced. The testers will gather on June 20 to 24 at Asbury Park, N, J., with headquarters at the New Monterey Hotel.

Besides the various committee meetings there will be ten main sessions at which papers of unusual interest will be presented and discussed. The sessions, as arranged, are as follows: (1) Miscellaneous committee reports; (2) preservative coatings and textiles; (3) presidential address and reports of administrative committees; (4) cement and concrete; (5) road materials and concrete aggregates; (6) ceramics, lime and gypsum; (7) testing and nomenclature; (8) petroleum products; (9) steel and wrought iron; (10) cast iron, corrosion and non-ferrous metals.

List of Machinery Dealers

The Far Eastern Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., has compiled a list of importers and machinery dealers in British Malaysia. It contains all the latest information and copies can be obtained by writing to the bureau, referring to number FE—18005-A.

Business Conditions as the Big Banks of the Country See Them

Fifty Per Cent Tax on German Goods Not Satisfactory to Manufacturers in England

The London trade representative of the Guaranty Trust Co. of New York reports that the tax of 50 per cent which is being levied on the declared value of all German exports to the United Kingdom is not working satisfactorily. It has already been modified by several amendments which have made it possible for a fairly large volume of German goods to enter England. These amendments are mainly designed to permit the admission of goods contracted for before March 8, 1921, or the admission of such goods that cannot be produced or worked elsewhere than in Germany and by companies of which the capital is not less than 90 per cent British.

During the last few weeks there has been a great rush of German goods to England. Some British ports in fact have been choked with German imports which cannot be released until proof is produced that they were contracted for prior to March 8. Critics of the Reparation Act point out that it will not be a very difficult matter to evade this provision of the act regarding the German origin of the goods. There is nothing to prevent plants being established in neutral countries where machines of German manufacture may be assembled and thence sent to England. Poland, for example, might easily be used for this purpose and the goods thus assembled could be imported into England and escape the 50 per cent tax on the ground that they were of Polish origin.

At first glance the operations of the act would appear to be quite simple. The British importer pays into the British Treasury 50 per cent of the declared value of the German goods he is to buy. The importer pays this in British currency and receives a receipt which he turns over to the German exporter as representing a 50 per cent payment on the goods. This receipt is presumably good for its equivalent value in marks at the time when it is presented by the German exporter to the German government. The success or failure of the scheme, therefore, depends upon whether or not the German government will honor these 50 per cent receipts. Grave doubt already exists on this point and it is a fact that British firms are being notified by exporters in Germany that they will not sell except against payment of the full amount by checks on a German bank. The German exporter takes this stand on the ground that his government refuses to refund the 50 per cent retained for tax purposes by the British importer. Unless, therefore, some way can be found to compel the German government to refund this 50 per cent to the German exporter the British importer of German goods must either pay the tax himself or the German exporter will enhance his prices enough to cover the tax.

The Iron and Steel Trade

The Guaranty Trust Co. reports that very little business is being done in the iron and steel trades in Great Britain, and the output has fallen 40 per cent. The latest statistics available show that the number of workers had fallen in February, 1921, to 71 per cent of the number at the end of 1920, and a very large proportion of those remaining at work are on short time. The output of pig iron has been in excess of the demand, despite the fact that many furnaces have been closed down. Wages have been reduced 25 per cent in some branches of the iron industry. It is generally believed that the iron and steel trades will be confronted with American competition in the near future. Some large American steel firms have opened negotiations with Birmingham merchants with a view to shipping consignments of semi-finished material as soon as there is an improvement in the exchange.

A South Wales railway company has just placed an order for 5,000 tons of steel rails with a Belgian plant whose price was £6 per ton cheaper than that of the Welsh Rolling Mills. It was stated recently at a meeting of the London and South Western Railway that in consequence of the very high cost of British locomotives that company was purchasing American engines. It is estimated that orders to the value of £3,000,000 have been lost in England because of the inability of British makers to meet American and other competition.

Money and Markets from the Viewpoint of the National Bank of Commerce of New York

In the manufacturing countries of Europe the productive machinery is in better condition than it has been since the end of the war. Physical plants have been rehabilitated, railway congestion relieved and fuel shortage overcome. Unfortunately, under present conditions, the productive capacity of Europe, like that of the United States, cannot be profitably employed. Every country in the world has large stocks of imported merchandise awaiting absorption and in some localities stocks are so large that it is impossible to provide proper storage facilities. The absorption of this accumulation has begun, but is being retarded in the countries which are Europe's best customers because those countries are unable to dispose of their own products. This condition is further aggravated by the fact that the world-wide fall in commodity prices has affected primary commodities more than semi-finished and manufactured articles. The South American, Asiatic and Australasian communities which produce a large share of the world's raw material have had to bear the heaviest burden of price deflation, and as yet they have not recovered their commercial equilibrium.

The uncompromising attitude of British miners appears to contrast with the attitude of labor on the continent of Europe. There have been no important strikes or other labor disturbances on a large scale in the continental countries, and while further adjustments must still be made in labor conditions abroad as well as in America, the attitude of labor generally offers a basis for encouragement.

The settlement of the reparations terms was absolutely essential to the resumption of sound business. It should stimulate trade and will unquestionably have a favorable influence on business throughout the world. The rebuilding of export business must come gradually. Until present large stocks are absorbed, and a healthy demand once more established, artificial stimulation must be detrimental to the best interests both of exporters and their customers.

Railroads

The reduction of the Pennsylvania Railroad quarterly dividend from 1¼ to 1 per cent was not unexpected but it remains, nevertheless, a concrete illustration of the difficulties through which railroads have been passing. Not since 1880 has the company's dividend rate been so low as 4 per cent per annum.

Encouragement may be taken from the action of the state legislature of Pennsylvania in repealing the so-called Full Crew Law, the final vote being taken the day after the reduction in the Pennsylvania Railroad dividend. This is one of the first signs of a more intelligent attitude toward the railroads on the part of state authorities. The cost of this statute to the transportation companies of Pennsylvania during the ten years during which it has been in effect is estimated to have been $40,000,000. The Full Crew Laws were among the earliest measures which resulted in forcing on the railroads uneconomical expenditures. Such laws continue in force in a number of states, with an estimated annual charge on national transportation of approximately ten times the cost of the Pennsylvania statute.

Annual Triple Session of the Supply and Machinery Dealers and Manufacturers

An attendance of over 400 members and guests marked the successful spring triple session of the National Supply and Machinery Dealers Association, the Southern Supply and Machinery Dealers Association and the American Supply and Machinery Manufacturers Association at Atlantic City, May 16, 17 and 18. Following the usual custom separate executive meetings were held by all three associations as well as general meetings in which every one participated.

The first session of the Manufacturers Association was held at ten o'clock Monday morning in the Marlborough-Blenheim. The first order of business was the president's address delivered by Charles W. Beaver, of the Yale & Towne Manufacturing Co., of New York. Mr. Beaver commented on the growing importance of world trade to the American manufacturer and pointed out that this country could not reach full prosperity while other parts of the world were practically bankrupt. He called attention also to the fact that in the past approximately one-fifth of our goods have been exported and that consequently foreign commerce must be fostered in every possible way. He stated that the best way to do this was to maintain the first quality in goods, for which our manufacturers have always been famous, and to add to that a first quality service. The unpleasant fact was also brought out that the enormous debt must be paid and that those who have the wealth will have to pay it. The president closed with the statement that we could expect a steady return of business from now on.

The annual report of the secretary-treasurer, F. D. Mitchell, was then presented and following that the reports of the various committees. The membership committee through its chairman, John C. Ruf, of I. B. Williams & Sons, Dover, N. H., reported that forty-two new members had been added during the past year. Mr. Ruf said that although his committee had been unable to live up to its slogan of a member a week he felt that under the circumstances attending a commercial depression the results attained were as good as could have been expected.

H. S. Demarest of Greene, Tweed & Co., New York, chairman of the standardization committee, quoted at length from the report of Henry R. Towne to the American Society of Mechanical Engineers on the adoption of the metric system as a national standard of weights and measures. He added a number of reasons of his own telling why the adoption of the metric system would not be advisable and altogether made a very clear case against the advocates of this radical policy. We shall hope to give Mr. Demarest's report more fully in a future issue.

At the conclusion of the committee reports the members listened to an address by Magnus W. Alexander, of the National Industrial Conference Board, on fundamental factors affecting wage and price movements. Mr. Alexander's presentation of this subject was very impressive and left those present with a good deal to think about.

The morning sessions of the other two associations were devoted to reports and other routine business dealing with other particular problems. In the afternoon a joint meeting was held at which addresses were made by: W. P. Simpson of the C. T. Patterson Co., Ltd., on "Southern Conditions"; by Melville W. Mix of the Dodge Manufacturing Co., on "Business Conditions," and by S. N. Thompson of the White Co., on "Motor Truck Transportation." For Monday evening the entertainment committee had arranged a vaudeville program followed by an informal dance.

At the session of the manufacturers association on Tuesday morning addresses were made by members of the other two associations on present problems in our industry from the dealer's viewpoint. The meeting was then turned over to Charles Coolidge Parlin, of the Curtis Publishing Co., who spoke on business of today and tomorrow. Mr. Parlin's address was illustrated by charts prepared in his department of the Curtis Publishing Co. and consisted of a logical analysis of present business conditions, showing that the present depression is due more to lack of buying willingness than to lack of buying power. Being an advertising man, Mr. Parlin naturally wound up with a few words about the power of advertising to produce business.

Tuesday morning and afternoon were devoted by the dealers associations to discussions of supply and demand, raw material and labor conditions, price tendencies and finished products, and over-head costs. The formal ball of the meeting was held in the Marlborough-Blenheim Ball Room at 9 p.m. on Tuesday and was very successful.

Abolition of Excess Tax

The final meetings were held Wednesday morning when reports of the resolutions and nominating committees were received and acted upon, and the newly elected officers were introduced. The resolutions committee of the manufacturers association offered a resolution urging the abolition of the excess profits tax and the reduction of the high surtax rates on individual incomes and also urged that every possible means of retrenchment be tried before additional taxes were imposed to make up for the ones abolished.

The second resolution set forth as the duty of all American manufacturers, and particularly of the members of the association, the support in every possible way of the reliable and worthy corporations formed under the Edge Act. Both resolutions were passed unanimously.

Officers Elected

The chairman of the nominating committee read his slate and forthwith moved that the nominations be closed. The motion was carried and the secretary cast the ballot for the following new officers of the association: President, N. A. Gladding, E. C. Atkins & Co., Inc., Indianapolis, Ind.; first vice-president, Irving W. Lemaux, Indianapolis Brush and Broom Manufacturing Co., Indianapolis, Ind.; second vice-president, John C. Ruf, I. B. Williams & Sons, Dover, N. H.; third vice-president, S. D. Baldwin, Cincinnati Rubber Maunfacturing Co., Cincinnati, Ohio. Executive committee: Joseph G. Deericks, Pittsburgh Steel Co., Pittsburgh, Pa; Dixon C. Williams, Chicago Nipple Manufacturing Co., Chicago; Edward Blake, Jr., Greenfield Tap & Die Corp., Greenfield, Mass.; A. T. Simonds, Simonds Manufacturing Co., Fitchburg, Mass., and H. F. Wright, Wright Manufacturing Co., Lisbon, Ohio; secretary-treasurer, F. D. Mitchell retained as secretary-treasurer.

The new presidents of the other associations, J. H. McKinnon of the Cameron & Barkley Co., Jacksonville, Fla., for the Southern Association, and Mr. Crannell Morgan of the Hardware and Supply Co., Akron, Ohio, for the National Association were then introduced and made a few remarks to the assemblage.

Industrial Cost Association in Conference

The National Industrial Cost Conference under the auspices of the Industrial Cost Association is being held this week at the Roycroft Inn, East Aurora, N. Y. The dates are May 26, 27 and 28.

A program of addresses and discussion covering a wide field of subjects which, however, are directly related to cost accounting in industry, has been arranged. The opening address of the conference will be delivered by J. W. Stannard, of the American Autoparts Co., Detroit, Mich., who will speak on "Post-War Changes in Economic Conditions." Other addresses are on subjects which are intended to bring out the viewpoint and opinions of various sections of the industrial world on cost accounting as applied to present business conditions. Many trade associations have signified their intention of attending the Friday sessions which have been arranged to cover their particular field.

At the dinner on Friday evening Elbert Hubbard II will be the toastmaster.

Convention of National Association of Manufacturers Features Foreign Trade

Foreign trade was the subject which predominated in importance at the twenty-sixth annual convention of the National Association of Manufacturers, held at the Waldorf-Astoria Hotel, New York City, on May 16, 17 and 18. The gathering was the largest and most successful in the history of the organization.

The program of speakers contained the names of many men of importance. The Honorable Herbert Hoover, Secretary, Department of Commerce, making his first public appearance in New York since he became a member of President Harding's cabinet, addressed the gathering at the closing session. Mr. Hoover was ably assisted on the program by such men as Simeon D. Fess, Representative in Congress from Ohio, Admiral William S. Benson, Chairman of the United States Shipping Board, and Eugene Meyer, Jr., of the United States War Finance Corporation.

The meeting of a large number of men of weight in the field of business and industry is of great import; but the convention was even more noteworthy on account of the presence of so many diplomats and representatives of foreign countries. A conference on the subject of world trade was attended and participated in by ambassadors, ministers, charges d'affaires, consuls, and other dignitaries, who are diplomatic and commercial representatives in this country of about forty foreign nations. More representatives of foreign governments attended the convention than had ever assembled in any one place in the country, outside of the national capital.

In addition to the group of foreign representatives, the National Government was represented at the conference in a Trade Advisory Section, at which there were advisers from the State Department, the Bureau of Foreign and Domestic Commerce of the Department of Commerce, the Pan-American Unions, and other administrative departments. The several Government departments were represented by special exhibits in the suite set aside for the conference.

Opening of Program

The convention opened on Monday afternoon with a session devoted both to the appointment of committees on Rules and Order, Credentials, Resolutions, Reception, and Foreign Trade, and to the reports of the standing committees on Immigration, Industrial Betterment, Health and Safety, Open Shop, Regulation of Combinations, Patents, Taxation and Merchant Marine. In the report of the committee on Open Shop, which committee is under the chairmanship of Clarence E. Whitney of the Whitney Manufacturing Co., Hartford, Conn., an open shop was defined as "a shop in which workmen are employed without respect to their membership or non-membership in any lawful organization operating in a lawful manner."

Monday evening's session was devoted to addresses, Jules S. Bache, of J. S. Bache & Co., speaking upon the subject of "Upbuilding of Business Dependent Upon Future Taxation Policy," Frederick A. Wallis, Commissioner of Immigration for the Port of New York, upon "The Immigrant, an Economic Problem," and Wm. McClellan, president of the American Institute of Electrical Engineers, upon "Public Utilities and Their Relation to Industry." Mr. Bache dealt with the depressing effect of present taxes on business, and he favored the sales tax as a remedy for the revenue problem. Among his statements was the following:

Favors Sales Tax

"The sales tax, if enacted and placed on the statute books of the United States, will, with the exception of the money raised through customs duties and the tobacco tax, be the only honest tax in its application and its results that we have on these statute books. It will be honest for two reasons because every cent collected under it will go to the United States Treasury, and, above all, because it states in its initiation that it is a consumption tax, pure and simple, paid in totality by the ultimate consumer, while the other taxes are consumption taxes, thinly or wholly disguished, but nevertheless consumption taxes."

Mr. Wallis went exhaustively into the operation of the immigration laws, conditions past and present at Ellis Island, the classes and character of immigrants received there, and incidentally, he spoke in condemnation of the treatment of immigrants by some marine and railroad transportation lines. The problem, which is "the immigrant himself, not immigration," said Mr. Wallis, "can be met, both socially and economically, by scientific selection, intelligent distribution and broad assimilation." Among the Commissioner's statements were:

"Revision of the system of handling these people is needed before this nation can be assured of getting the better class of immigrants. Some method of preferential selection must be immediately put in operation at the ports of embarkation. I believe that 90 per cent of the 'culling' out process could be done on the other side at the ports of embarkation. It is said that the other nations would not permit us to come to their shores and pick the desirable from those seeking emigration to this country. If this policy were adopted either through diplomacy or legislation or both, I believe it would only be a short time before public opinion in those countries would so assert itself that the nations would be asking us to send our doctors and our inspectors to their ports. Inspection over there is infinitely better than rejection over here."

On Tuesday morning the annual address of the president was given by Stephen C. Mason. After expressing his sense of the importance of the present convention because of the large number of representatives of foreign countries present, and the value of their counsel in the solution of the present economic problems, Mr. Mason considered conditions in the business world and the means of remedying some existing evils. Among his statements should be noted:

"A great deal depends, however, upon our industrial success in arriving at a basis of lower cost and quantity production. Workmanship and skill, I firmly believe, ought to rank higher in both industrial operation and in the eyes of public opinion than membership in a union. Our people must, at once and for all time, abandon the idea that wealth can be created merely by expanding credit to suit our fancies, and once again return to the well established truth—that wealth can only be made by efficient, abundant and economic production."

Mr. Mason was followed by Henry Abbott, treasurer of the association, and George S. Boudinot, secretary, both of whom rendered reports.

Conference of Foreign Representatives

The afternoon session on Tuesday was presided over by His Excellency J. J. Jusserand, Ambassador of France, and it was devoted to addresses on world trade by representatives in the United States of foreign countries. The speakers were as follows: Augusto Cochrane de Alencar, Ambassador of Brazil; Dr. Carlos Adolfo Urueta, Minister of Colombia; Dr. Rafael H. Elizalde, Minister of Ecuador; Sadigh-es-Saltaneh, Minister of Persia; Jonkheer W. H. de Beaufort, Charge d'affaires of the Netherlands; W. T. Munthe de Morgenstierne, Commercial Adviser, Legation of Norway, and Dr. Charles Bruggman, Secretary of the Legation of Switzerland.

On Tuesday evening another session on world trade was held, the honorary chairman being Senator Vittorio Rolandi Ricci, Ambassador of Italy. The speakers were Senator Ricci; Dr. Julio Bianchi, Minister of Guatemala; Armas Herman Saastamoinen, Minister of Finland; John Boyce Broderick, Commercial Counsellor of the British Embassy; Georg Bec[illegible], Consul General of Denmark; Don Alejandro Berea, Consul General of Spain; and Iuming C. Suez, Consul of the Republic of China. Sen-

ator Ricci presented a practical discussion of the present state of the industries of his country. He said that, "While Italy has not escaped the effects of phenomena general throughout the world, such as high costs of raw materials, fuel and building, she faces the crisis without need of foreign help or credits." Regarding the steel and machinery industry, he said, "The work in the majority of the branches of this industry is limited by difficulty in disposing of the finished product. This difficulty is due, partly at least, to successful foreign competition. All those branches of this industry working on government orders, such as those producing railroad material, rolling stock, and the industries for the production of electric material, machinery, and appliances, are working to their full capacity."

Mr. Suez spoke of methods by which America may develop her trade with China, stating that the United States needs a strong central organization to study the needs of China and to meet them, if we would capture that market or even hold what trade we have gained during the past war. Dr. Bianchi covered very well the subject of relations between U. S. and Latin America.

The session of Wednesday morning was the last one devoted to addresses of diplomatists. Addresses were made by the following: Frederico Alfonso Pezet, Ambassador of Peru; Prince Casimir Lubomirski, Minister of Poland; Prince Antoine Bibesco, Minister of Roumania; Dr. Slavko Y. Grouitch, Minister of the Serbs, Croats and Slovenes; Dr. Bedrich Stepanek, Minister of Czechoslovakia; Capt. Axel F. Wallenberg, Minister of Sweden; Dr. Don Santos A. Dominici, Minister of Venezuela.

Mr. Pezet declared that his country wanted goods from the United States, but was not able to pay inflated prices for them. He believes the United States financiers and statesmen should arrange to see that certain of the other American republics are properly financed. Among Dr. Grouitch's statements, the invitation to American capital to the Serb-Croat-Slovene State is interesting.

The summary of the opinions of the foreign dignitaries was that closer contact and increased trade between their countries and the United States would be to our mutual advantage.

American Viewpoint

The American viewpoint on world trade was brought out in the afternoon session on Wednesday. Eugene Meyer, Jr., managing director of the United States War Finance Corporation, spoke on "A Missing Link in International Finance and Its Relation to the Market for American Manufactures." He said, "The missing link I have in mind is a properly established market for international securities—that is, for securities having free, broad, public markets in the United States and in foreign countries.

"If there is any idea that in the future we are going to play a larger rôle as a financial center in this world situation than we have in the past, we must determine to establish an international security market in this country. And let us remember that merely the dollar obligations of the foreign borrowers, no matter what the quantity may be, will not make an international security market. We ought to have here securities which are readily marketable in other countries. The speculative investor, above all things, wants a market, an active market and a public market. If the resources of the speculative investor are to be availed of for the general situation and in the general interest, and if bankers consider that these funds are worth obtaining, it would seem appropriate that the facilities of our great public markets should be used as their officials would be glad to have them used. The stock exchanges, I understand, are anxious to furnish their facilities in connection with sound business that seems to be in the public interest. The long term funds must come from the investors; the short term money ought to come from the banks and bankers; and the sooner we can enlist investment funds on a sound basis, the better."

Hoover Talks

The convention closed with a banquet on Wednesday evening. The principal speaker was the Honorable Herbert Hoover, Secretary of the Department of Commerce of the United States. Mr. Hoover defended the "open-door" policy in world trade, and he asserted that the U. S. was willing and ready to adhere to that policy, as she has done. The future peace of the world, as well as its economic readjustment, is being menaced by some nations who are striving for domination, declared the Secretary. Some of his remarks are as follows:

"It is my purpose tonight to call your attention to the fact that there is a rapid drift in many countries away from these foundations and that it has a direct reflect upon us and upon many other countries who adhere with us to these beliefs. It arises, first as the pre-war offspring of the class governments of Europe driving for nationalistic domination; second, from continuation of the rigid contradictions at the hands of government during the war; third, from the economic desperation growing out of the war. There are many of these growths and tendencies that make for the direct or indirect closing of the open door, the reductions of equality in opportunity.

"If these tendencies are to continue into large realities, sooner or later those states which shall hold the open door and equality of opportunity will be at the parting of the ways from these policies. We do not have in the United States today a combination of exporters able to control the distribution or price of a single export commodity; we have no combination of importers to control the price of produce from abroad; we have no combinations of capital that can, by unfair competition, crush the energies of other nationals. We have sought no exclusive concessions of the resources of other peoples; we have admitted all nationalities to exploit our raw materials and resources on the same terms as our citizens.

"But if great trusts are to grow up abroad that by weight of wealth can crush the individual trader, if the control of our agricultural produce by combinations of buyers is to be attempted, if our people are not to be allowed the development of the natural resources of other countries on the same terms as the citizens of those countries have in ours, if nations are to put their strength behind the finding of exclusive concessions to exploitation first in one country and then another in effectual closing of the open door, if governments are to find capital with which to stimulate domination of the world's raw material—then the public opinion of this and other open countries will demand advantages to their citizens of the same order. We want only that share of the world's commerce that our citizens can secure without special privilege.

"It would indeed be a fateful day in the history of the world if it abandons these basic policies of the open door and equal opportunity. It means the irresistible pressure to exert intolerant national strength; it means the enforcement of this strength by the weight of government, which means armies and navies; it means a long sequence of reprisals, of favored nation classes, of reciprocity arrangements, of discriminations through which the weak always go to the wall and the strong always win.

"This is indeed not a threat, it is not an announcement of a national policy. It is a plea that the world should 'stop, look and listen,' for if the day comes when the United States with her gigantic resources and the intelligence of her people, shall be forced to enter upon those courses in her own protection, it will be a day of infinite losses to real progress and real liberalism."

"The American Merchant Marine as an Aid to World Development," was the subject of Admiral William S. Benson, Chairman of the U. S. Shipping Board. Admiral Benson reported material progress in the adjustment of the labor situation, despite the grave issues which had been faced during the past few weeks.

Simeon D. Fess, Representative in Congress from Ohio, was the last of the speakers on the program.

The newly elected president of the association, J. E. Edgerton, of the Lebanon Woolen Mills, Lebanon, Tenn., outlined the policy of the organization for the coming year. The other new officers are: Vice-president, William H. Barr, National Founders Association, Chicago, Ill.; vice-president and general manager, J. P. Bird, National Association of Manufacturers, N. Y. City; secretary, George S. Boudinot, National Association of Manufacturers, N. Y. City, and treasurer, Henry Abbott, Calculograph Co., N. Y. City.

Washington Notes

By Paul Wooton
Washington Correspondent

Ordnance officers to be trained in the future are to be schooled particularly in the duties connected with overseeing production in factories and with the making of contracts. One of the weak points of our military and industrial organization disclosed during the World War was the fact that ordnance officers had too little knowledge of factory practice, and the manufacturers, including superintendents and other members of their factory staff had too little knowledge of the requirements for ordnance. Major General Clarence C. Williams, Chief of Ordnance of the army, is concentrating his attention at this time on plans for officers' training camps. He emphasizes the need for training men to superintend production and to handle the highly important contracts it is necessary to make with industry.

General Williams is much concerned with the need for the army to keep abreast of mechanical development. He points out that mechanical development is progressing now at a much faster rate than it was at the close of the Civil War. The mechanical equipment of the army used in the World War will become obsolete in fewer years than did the mechanical equipment in use at the end of the Civil War. For that reason he is very anxious to keep up the research work being done by the Ordnance Department and to maintain a sufficient volume of manufacture at the arsenals to accomplish that end.

Just at the present time General Williams is interested in the development of the mechanical transportation of artillery by motor vehicle. Just as mobile guns on railway carriages have revolutionized coast defense in that they have largely supplanted guns on fixed mounts, General Williams believes that effects even more far-reaching will result from the increased possibilities of mobile artillery on automotive mounts. He believes the time is not distant when guns as large as those of eight-inch caliber will be handled with great facility wherever motor vehicles can go.

Oppose Tax on Trucks

Several representatives of the automobile industry have appeared before the Senate Committee on Finance to emphasize that the automobile industry is the heaviest burden bearer of the present tax load. In pointing out that the industry is taxed more than is any other, it was shown that there are five main levys on it, as follows: National and State income tax, common to all industries; sales tax, limited to automobiles and a few other industries; taxes on repair parts, a permanent charge on the life of every automobile, a tax specific to the industry; State license and registration fees; scattering municipal and personal property taxes.

It was pointed out to the committee that there are no federal sales taxes on other units of transportation, such as steamships, locomotives, trolley cars and horse-drawn vehicles. Attention was called to the fact that the motor truck is the farmer's private short-haul transportation line. The definite need that the truck is filling in agricultural sections is indicated by the fact that Iowa registered 29,800 motor trucks during 1920, an increase of 110 per cent over the preceding year. Throughout the country last year 5,000,000 head of live stock were hauled to the market by motor truck. These and other important facts were brought to the attention of the committee, which now is considering tax revision.

Weights and Measures Conference

The principal items making up the program for the fourteenth annual conference on weights and measures, May 23 to 26, in Washington, are as follows: The Weight Problem in Interstate Commerce; Destination Weighing of Coal; Enforcement of Law Providing for the Marking of the Weight on Wrapped Meats; Bread Legislation from the Baker's Standpoint; Bread Weight Legislation in Illinois; Enforcement of Bread Weight Legislation; Testing of Mine Scales; Testing of Liquid Measuring Devices; Standardization of Containers for Foods; Net Weight Marking on Packages of Commodities Other Than Foods; Proper Equipment for Testing Wagon and Automobile Truck Scales; Proper Sealing of Commercial Weighing and Measuring Apparatus; Uniform Bushel Weights.

The metric system bill now before Congress is to be formally discussed as is the "slack-filled package" bill.

Compulsory Standardization

The bill to fix standards for hampers and other types of baskets has been reported favorably to the House of Representatives by the Committee on Coinage, Weights and Measures. While this bill, of itself, is not of interest to the machinery industry, it is of significance in that it shows the tendency on the part of the committee and on the part of Congress to standardize in the matter of weights and measures.

Foreign Notes

During the last few days of April the first American locomotives (of the Baldwin works) 150 in number—ordered by the Roumanian government, arrived at the port of Constantza, on the Black Sea. How badly these engines are needed may be gathered from the following remarks. All over Roumania the railroad traffic is nearly at a stand. For a net of about 15,000 kilometers there are scarcely 300 engines available. If the present situation does not improve in the very near future the crisis must lead to untenable conditions. The government has tried to meet these difficulties by inviting foreign capitalists to take charge of the locomotive and other workshops of the state railways. Two foreign concerns, the French Vulcan Works and the British Garvens Co., have accepted this proposition and will take charge of the establishments. These two firms have engaged themselves to build within a period of seven years 2,500 locomotives, 1,500 passenger cars and 15,000 freight cars. After a certain number of years, that is to say after the country possesses at least 5,000 locomotives, the above works will be turned over again to the Roumanian state. In connection herewith it may be added that railroad conditions are not much better in any of the other Balkan states. Servia, Bulgaria, Greece, Turkey, etc., are suffering from similar conditions. All those countries offer a valuable market for American machinery.

On the occasion of a visit paid the Basle Fair the Mexican Consul General at Berne, Señor Barreda, declared that Mexico was anxious to establish closer commercial relations with Switzerland and that his country was especially in the market for all kinds of machinery of Swiss origin.

Communism in Italy

The Italian press publishes some interesting data about the breakdown of a communistic enterprise. The following abstract may be of interest to the readers of the *American Machinist*:

On April 1, 1920, a company styled "Co-operative Garibaldi," was formed at Genoa. The Italian government (Nitti) placed a shipping tonnage valued at 60 million lire at the disposal of the company, exempt from any interest. The superior principle of the company, the members of which included seamen of all grades, was: highest wages, least work, comfortable rooms and best kitchen. Faithful to the communistic ideas all ships of the company had double the crew of other ships of the same size. Large cabins, comfortable dining and smoking rooms were built on board, in consequence of which the space for cargo was very limited. Arriving at a foreign port the ships remained there until it happened that some freight was offered. Today, exactly one year after, the company is indebted to such an extent that even wages cannot be paid any more. After this experience the "administration" has decided to dissolve the company.

Switzerland Gets Orders

The Bulgarian government has entered into an arrangement with Swiss capitalists and manufacturers, according to which all locomotives of the Bulgarian state railroads will be repaired in Switzerland, where also considerable orders for all kinds of machines and tools will be placed. One-third of the amount to be paid for the repair work and purchases will consist of Bulgarian corn supplies.

Beginning Jan. 1, 1921, railway, freight and passenger fares in Victoria, Australia, were increased 18 per cent, as a result particularly of the increased cost of coal, according to an announcement in the Melbourne *Argus*.

Dr. Edward B. Rosa, Noted Scientist, Dies

Dr. Edward Bennett Rosa, chief physicist of the United States Bureau of Standards, died suddenly in his office in the bureau on May 17.

Dr. Rosa had done notable work in electrical research. He was born in the scientific field, and particularly in electrical research. He was born in Rogersville, New York, Oct. 4, 1861. After graduating from Wesleyan University, Middletown, Conn., in 1896, he entered Johns Hopkins University, Baltimore, and received the degree of Doctor of Philosophy. Serving for short periods as instructor at the University of Wisconsin and as professor of Physics at Wesleyan, he became the chief physicist of the Bureau of Standards in 1901.

One of his first achievements was to develop the physical side of the respiration calorimeter with Professor W. O. Atwater, at Wesleyan. This apparatus was of great value in the pioneer investigations of the value of foods.

With Dr. Dorsey as collaborator, Dr. Rosa in 1907 began work on the determination of the ampere which has been perfected until it is now possible to define the ampere in a satisfactory manner. With Dr. Grover he collected practically all the known formulas for computing inductions. This collection is known throughout the world as a model.

Another achievement was to definitely establish the laws governing electrolytic corrosion, a problem of major importance to public utility companies, particularly those operating underground gas and water pipes and electric railways.

In the World War, Dr. Rosa developed a number of scientific instruments of great value to the American forces in France. Among these were a sound ranging device for locating big guns, the geophone for detecting mining operations, the development of aircraft radio direction finders by which enemy ships and aircraft could be located. Under his direction the Bureau of Standards has established what is perhaps the finest radio research laboratory in the country. Dr. Rosa has also perfected devices to insure safety devices in industrial plants.

He was a member of several notable scientific societies including the National Academy of Science. In March, 1894, Dr. Rosa married Mary Evans, of Harrisburg, Pa., who survives him.

Three hundred furloughed employees of the Pennsylvania Railroad in Ft. Wayne, Ind., returned to work May 9 after a period of idleness of more than two months. Employees of the machine shop, the erecting department, copper shop, blacksmith shop, boiler shop, paint and cab departments are included in those called back to their jobs.

France and French Possessions To Receive a Proportion of the Value of Imported German Goods

The French "Journal Official" for April 22 contains a law, dated April 21, which provides that importers of German goods are to pay to the French treasury a proportion of the value of such goods, to be fixed by decree, but not to exceed 50 per cent. The receipt for the sum paid is to operate as a discharge as against the person to whom the purchase price of the goods is due. The law defines "German goods" as: (1) All goods which are regarded, for Customs Tariff purposes, as of German origin; (2) all goods produced, manufactured or worked up in a country other than Germany, but in which German elements (raw material, working up, etc.) account for 50 per cent or more of the value.

The provisions of the law do not apply to foods sent in transit, or deposited in bonded warehouse; or to goods ordered from German firms before March 8 last and wholly or partly paid for before that date. General exemptions from the operation of the law may be granted by a Ministerial Committee in consideration: (1) Of the nature and kind of goods; (2) of the conditions or place of production or manufacture; (3) of the importation of goods under the "temporary importation" regime; (4) of the restoration of the devastated districts (when goods are imported under prescribed conditions); (5) of the provisions of Article 68 of the Treaty of Peace (relating to imports into Alsace-Lorraine).

Individual exemptions may also be allowed in respect of contracts in course of execution.

The law extends to Algeria and to French colonies and possessions, and steps are to be taken to apply it also in French protectorates.

New York State to Train Vocational Teachers

The State of New York is developing a broad program of industrial and technical education as a part of the public school system. The state is selecting each year twenty-five men from the trades and technical occupations and providing them with a scholarship of $1,000. The men selected spend one year in a teacher training institution preparing to teach their specific occupations.

The University of the State of New York is offering twenty-five scholarships to qualfied trade and technically trained persons who desire to prepare themselves for teaching. Persons selected to hold these scholarships who satisfactorily complete the prescribed one year resident industrial teacher training course are licensed for life to teach their specific occupations in the vocational schools of the state. The salaries paid vocational teachers now range from $1,800 to $3,500 per annum.

Spring Meeting of the Taylor Society

The spring meeting of the Taylor Society was held at the Hotel Statler, Cleveland, Ohio, May 19 to 21. After the addresses of welcome by Alexander C. Brown, president of the Cleveland Chamber of Commerce, and Richard A. Feiss, vice-president of the Taylor Society, the sales executive session was opened with W. C. Dunlap, vice-president of the American Multigraph Co., presiding.

The methods of compensating salesmen were discused by C. K. Woodbridge, sales manager of the Dictaphone department of the Columbia Graphophone Co., and by Charles J. Crockett, Prof. Harry R. Tosdal, W. C. Dunlap and others.

At an administrative officers' session, with D. C. Mills, chairman of the board of the Federal Reserve Bank of Cleveland, presiding, the value of an index number of physical production to administrator and manager was shown by Carl Snyder, statistician of the Federal Reserve Bank of New York, and discussed by Col. Leonard Ayres, Dr. N. I. Stone, E. W. Hulet and others. The plan endeavors to make possible more exact information concerning general business conditions.

The second or plant managers' session, was devoted to a study at first hand of a plant in which scientific management has been applied in many, if not all departments. The plant was the Clothcraft shops of the Joseph & Feiss Co. After a short preparatory address by Richard A. Feiss, manager of manufacturing, Keppele Hall, superintendent of planning told what to look for in going through the plant.

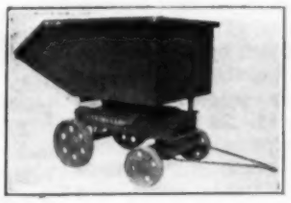
Opportunity was given to see all the departments and processes. A visit to the recreation grounds was followed by a luncheon in the shop restaurants, as guests of the company. Then the visitors were divided into groups in accordance with their special interests, each group having as a guide the head of that department or process. These included: employment and service; general planning; routing and assignment; time study; supply and storage; and others.

Two other sessions were held, one on personnel administration and the other on industrial relations. The former was presided over by Morris A. Block, of the H. Block Co., the latter by William G. Lee, grand chief, Brotherhood of Railway Trainmen. At the former session performance ratings and bonuses for salaried employees was discussed by Howard G. Benedict, while Morris L. Cooke took up the subject of unemployment scores. The session on industrial relations consisted of a symposium on joint action of employees and management in establishing standards, tasks, rates and other standard conditions. The various angles were presented by John M. Cormody, production manager, H. Block Co.; Meyer Perlstein, vice-president, International Ladies' Garment Makers' Union; W. R. Basset, of New York.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Trailer Car, Scoop-Body
Easton Car and Construction Co., 50 Church St., New York, N. Y.
"American Machinist," Feb. 24, 1921



The body is mounted on a structural-steel turntable and may be dumped from any one of the four sides. The wheels are equipped with roller-bearings. The low height of the car makes it convenient for hand loading. The car can be used for handling such materials as sand, coal, castings, cinders and metal chips. It is equipped with flat-tread instead of narrow-gage-track wheels, not being confined to the limits of a track system. It can be handled by one man, where single cars, either hand-pushed or pulled, can be employed. The capacity of the car is 27 cu.ft.

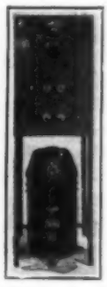
Platform, Lift-Truck, Pressed Steel
Powell Pressed Steel Co., Hubbard, Ohio
"American Machinist," Feb. 24, 1921

The platform is made of one piece of sheet steel and is formed by a cold process, which sets the material to the form required. The height, or inside clearance, of the platform is generally from 6½ to 12 in. The corrugations used to strengthen the platform are 1½ in. wide by ¾ in. deep and spaced at 6-in. centers. It is stated that a platform made of No. 9 gage steel will easily carry from 15,000 to 20,000 lb., and may be overloaded considerably, that the life of a platform is practically endless, and that no repairs are required. Racks or boxes may be built onto the platform, and to provide a large flat top a sheet-metal plate is spot-welded to the top of the platform.

Centers, Fluting, Multiple-Spindle, No. 2½
Miller & Crowningshield, Greenfield, Mass.
"American Machinist," Feb. 24, 1921

The device is intended for use on the table of a milling machine when fluting taps or reamers, and it consists of an indexing head and a tailstock. It can be furnished with either three or four spindles, the same range of work being handled in each case. The spindles can be turned simultaneously in the same direction by means of the crank. The indexing for any number of flutes up to 20 can be done by means of a single full turn of the indexing handle, change gears being provided to vary the ratio. The spindles are clamped simultaneously by means of one handle. The tailstock is separate from the head, being made either solid or with separate vertical adjustment for each center. Either round or square stock can be held.

Charger, Storage Battery, Automatic, for Electric Industrial Vehicles
Acme Electric and Manufacturing Co., Cleveland, Ohio
"American Machinist," Feb. 24, 1921

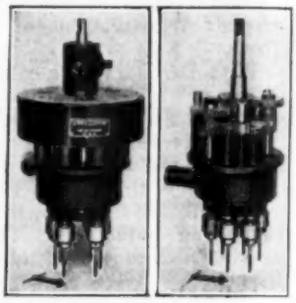


The device is intended to charge the battery at the rate recommended by the battery manufacturer. The charger takes up a little more than a square foot of floor space. Its motor is built for heavy service, and the generator is constructed to suit the battery. The shaft is one solid piece, rotating on ball bearings, the dynamically balanced armature and rotor both being mounted on it. The commutator has a large radiating surface and maintains a low operating temperature. Cool operation is afforded by a Sirocco-type fan, which ventilates the machine by drawing air through the windings. An automatic operating panel accompanies the charger. It is made of rubber-finished electrical slate mounted on an angle-iron frame, and contains the instruments and switches.

Block, Size, Adjustable
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," Feb. 24, 1921

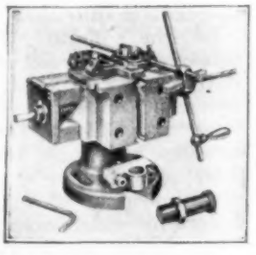
The block is adjustable in size and intended for use in setting cutting tools to height above a surface. It is made of carbon steel, hardened and ground all over, and the sliding surfaces are lapped. In the inclinded surface of the larger piece is a T-slot, in which slides a small T-head stud that extends up into the hollow sliding member. A tapered hole in the upper end of this stud receives the correspondingly pointed end of the knurled-head screw, a turn of which serves to clamp the sliding member in any position. The setting is, of course, measured by means of a micrometer over both members.

Head, Tapping, Multiple-Spindle
John H. Dorman & Son, 5148-52 Hudson Blvd. West, West New York, N. J.
"American Machinist," Feb. 24, 1921



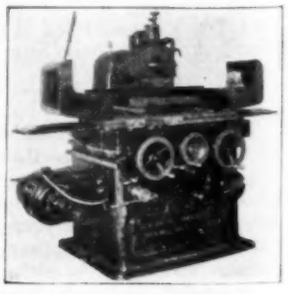
The device is intended for tapping simultaneously six holes grouped together, the holes not lying on the circumference of the same circle. The head at the left is completedly assembled, while the housing has been removed from the head in the view on the right. The gears driving the tapping spindles are compounded, the driving spindle carrying two gears of different sizes. In this way the taps can be given the same speed of rotation, although they are placed at different distances from the center line of the driving spindle. It is possible also, to vary the speeds of the different spindles by means of the gearing, so that taps of different pitch can be used at the same time. The direction of rotation reverses automatically when the head is raised.

Chuck, Universal, Drilling Machine
John Chuck Co., Milwaukee, Wis.
"American Machinist," Feb. 24, 1921



The device is intended to be used for holding work while performing such operations as drilling, milling, grinding and tapping, being employed chiefly on the tables of drilling machines. False jaws are made to conform to the work. An adjustable arm is furnished to hold the stop. The jaws are operated by means of a right- and left-hand screw, thus being self-centering. The screw is of high-grade steel and provision is made for takng the end thrust. A handle is provided, by which the screw can be operated from either end of the chuck. The body and crossheads of the chuck are made of cast iron. Provision is made for taking up the wear on crossheads. Extension bases can be furnished for long work.

Grinding Machine, Surface, High-Duty, Type C
Diamond Machine Co., 9 Codding St., Providence, R. I.
"American Machinist," Feb. 24, 1921



The machine is intended to do small work, although it can handle pieces up to 10 in. wide, 24 in. long and 8 in. high. It is made much heavier than the usual small surface-grinding machine, so that rigidity and freedom of vibration may be obtained. The machine has individual motor drive, the motor being a component part of the machine and standard in all respects. The wheelhead is cast integral with the vertical column, the combined column and head being adjusted vertically to suit the thickness of the work. The ways are completely covered by metal guards. The traverse is automatic, and adjustable from 0.001 to 0.020 in. per stroke.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The Brown Hoisting Machinery Co., of Cleveland, Ohio, announces the opening of a southern office in the Whitney-Central Bldg., New Orleans, La. The states of Texas, Louisiana, Mississippi, Alabama, Georgia and Florida will be covered from this office. Charles H. White, manager of the new office, has been with the Brown company for a number of years, and is an experienced sales engineer on all types of Brownhoist products. Among these are locomotive cranes, buckets, electric hoists, trolleys and a wide range of cranes and hoists. Other branch offices of the company are located at New York, Pittsburgh, Chicago and San Francisco.

The Air Reduction Sales Co., New York City, has secured control of the National Carbide Corporation, of Virginia, with a new plant at Ivanhoe, Va., and beginning May 1 will direct the policy and control the operation and sales of that corporation. The Carbide produced at the new plant will be marketed in the future as "Airco Carbide" through the chain of Airco distributing stations.

The Modern Tool Co., Erie, Pa., announces arrangements whereby the E. L. Essley Machinery Co., 551-557 Washington Blvd., Chicago, Ill., becomes the exclusive selling agent in Chicago territory for Modern plain and universal grinding machines.

The Detroit office of the Black & Decker Co. (Baltimore, Md.), has been moved to 27 Watson St. C. G. Odell is in charge of this branch.

It is understood that Armstrong, Whitworth of Canada, Ltd., contemplate closing the entire works at Longueuil, Canada. The reason given is the failure of the Dominion government to provide tariff protection on the manufacture of locomotive steel tires, which is the chief product of the company.

Alfred Herbert, Ltd., Coventry, England, has moved its New York City office from 54 Dey St., to 50 Church St., room 275, the change becoming effective on May 1.

The Lancaster Iron Works, Inc., of Lancaster, Pa., has recently purchased the electric furnace business of the F. T. Ryan & Co., of Philadelphia, Pa. The Ryan company will handle all furnace business in the future from the Philadelphia office.

The Crane Company, Bridgeport, Conn., has awarded the contract for remodelling and enlarging its boiler house, to the T. J. Purdue Construction Co. The work will be arranged so as not to interfere with the regular operation of the plant. It is said that the cost of the work will reach $125,000.

The Master Motors Corporation, now located at Saginaw, Mich., will locate in Erie, Pa., as soon as a suitable plant has been erected. The concern was recently incorporated under the laws of Delaware, with a capital stock of $2,500,000. D. H. Palmer, Erie, Pa., is president.

The Dana Machine Co., Providence, R. I., has recently been incorporated under the laws of the State of Rhode Island, to engage in the machinery business. The capital stock of the company is $1,000,000, and the incorporators are: W. Irving Bullard, of Danielson, Conn.; P. LeRoy Harwood, of New London, Conn.; Frank I. Dana, of Providence, R. I., and F. R. Wheelwright, of Providence, R. I.

The Columbus Machine Works, the oldest manufacturing establishment in Columbus, Ind., has doubled its capitalization, raising it from $25,000 to $50,000. The company recently added a pipe threading machine to its manufacturing products and the increase in capitalization has been made to finance the increase in business caused by this product. The company was established forty years ago and Frank P. Boyd is the present general manager.

The Chrobaltic Tool Co., an Illinois corporation, has started a branch in Indiana, located in Michigan City. The company recently filed papers with the secretary of state showing a total of $25,000 of its capital stock was held in Indiana. C. H. Cannon, of Michigan City, is named as the Indiana agent.

The Black & Decker Manufacturing Co., Baltimore, Md., announces that the New York branch office, formerly at 141 Broadway, is now located in the Printing Crafts Building, Eighth Ave. and 33rd St. In order to co-operate more closely with jobbers in this territory, a service station has been established there, with a factory-trained mechanic in charge. A complete stock of parts will be carried and prompt efficient service will be offered to all users of Black & Decker products. G. R. Lundane, who is well known in the trade, is manager of the New York territory and is assisted by E. I. Firestone and R. T. Watts.

At the first annual meeting of the Kelly Reamer Co., Cleveland, Ohio, held on April 16 in its new plant, the retiring board of directors was re-elected for the ensuing year. They are: H. C. Putnam, president and general manager; W. A. Calhoun, vice-president; H. W. Strong, treasurer; A. C. Carter, secretary; G. H. Moore, assistant secretary; J. M. Davie, chief engineer. This company recently increased its capital stock from $60,000 to $250,000 and all shares offered were taken up by the present stockholders. An opportunity was afforded all the stockholders to inspect the new plant and the additional equipment which has recently been installed.

At a recent meeting of the board of directors of the Homestead Valve Manufacturing Co. at Homestead, Pa., a resolution was passed to increase the capital stock from $500,000 to $1,000,000.

The Slick-Knox Steel Co., Sharon, Pa., with factories in Elwood City and Wheatland, Pa., has been reorganized. The new name is the Sharon Pressed Steel Co. and the officers are: President, Harry W. Torney of Torney & Co., Inc., New York; vice-president in charge of sales, Albert W. Morris, formerly of the Harley Co., Springfield, Mass.; vice-president in charge of manufacture, Arthur E. Swan, formerly of the Crucible Steel Co., Harrison, N. J. The Sharon Pressed Steel Company's plants cover an area of approximately thirty acres and are equipped to make automobile and truck frames, pressed steel automobile car and boat parts and fittings, hot and cold pressings, hot and cold hydraulic forgings and disk wheels.

The Missouri Car Co., Central National Bank Building, St. Louis, Mo., will establish a machine plant for the manufacture of electric railway cars. The minimum output will be about 600 per year. All the machinery will be direct driven.

The Alabama Mica and Manufacturing Co. of Maryland is erecting a manufacturing plant at Anniston, Ala., for the purpose of grinding and cutting mica. The mica is mined on the company's property of 200 acres of valuable mica land in Randolph County, Ala. The officers of the company are Harry H. Wand, Chattanooga, Tenn., president; Hugh Brown, Chattanooga, Tenn., vice-president; J. Albert Tapley, Anniston, Ala., secretary and treasurer.

David A. Wright, machinery and equipment, 568 Washington Blvd., Chicago, Ill., moved on May 1 to a new location at Jefferson and Monroe Sts. The new show room will have approximately four times the space now occupied, with seven large windows. In addition the firm has a warehouse and factory where a large stock of machinery is stored and rebuilt. This plant is equipped with machinery for rebuilding machine tools.

The Dale Machinery Co. of Chicago, Ill., has been made sales agents for the Chicago territory for the combined Reed-Prentice Co., Worcester, Mass., the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., and the Becker Milling Machine Co., Hyde Park, Mass.

Normoyle & Lapp of Philadelphia, Pa., with offices at 514 Liberty Bldg., has been made sales agent in the eastern Pennsylvania territory for the combined interests of the Reed-Prentice Co. and the Whitcomb-Blaisdell Machine Tool Co., both of Worcester, Mass., and the Becker Milling Machine Co. of Hyde Park, Boston, Mass.

The Johnson-Thompson Foundry Co., which has been constructing a new plant in Birmingham, Ala., has taken out an additional building permit calling for additional construction to the amount of $20,000. The original permit was issued some months ago and work has been in progress on the plant since that time.

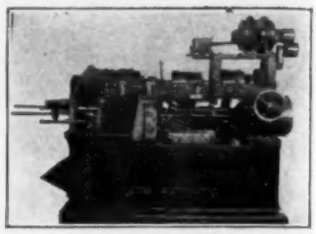
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Threading Machine, Two-Spindle, ¾-In.
Geometric Tool Co., New Haven, Conn.
"American Machinist," March 3, 1921

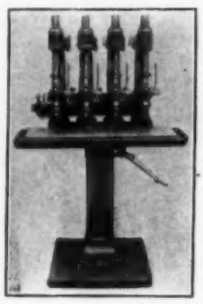
The bed of the machine carries two spindles, which are mounted in large bronze bearings. The spindles are driven by a single pulley, located at the rear of the machine, but may be operated and controlled independently by means of the change gear levers at both sides of the machine. The speeds are indexed according to the size of work being handled, but may be varied. Both spindles may be fitted with die heads for external threading, or may be fitted with taps for internal threading. Or, one spindle may carry a die head and the other may carry a tap. Each carriage is fitted with a two-jawed chuck operated by a hand-wheel. A single-geared pump forces oil through the spindle and die head against the work. The machine will cut U. S. Standard thread to ¾ in. in diameter.

Screw Machine, Automatic, Four-Spindle
Cone Automatic Machine Co., Windsor, Vt.
"American Machinist," March 3, 1921



Changes in the design have altered the appearance of the machine to a considerable extent, although the principle of the Cone automatic is retained in the present design. The frame carrying the camshaft rests upon uprights that are a part of the lower frame and that carry the spindle turret and driving mechanism. The upper frame furnishes the support for two auxiliary spindles, while two other spindles are carried upon the turning tool-slides, making four independently driven auxiliary spindles. The turning tools are supported by slides that have bearings directly upon the bed of the machine and travel in a direction parallel to the work. The machine is built in three sizes, the one shown handling bars up to 1¼ in. in diameter and producing pieces 6 in. long. Floor space, about 6 by 8½ ft. Shipping weight, 8,000 lb.

Drilling Machines, Sensitive, High-Speed, "Pecorp"
Providence Engineering Corporation, Providence, R. I.
"American Machinist," March 3, 1921

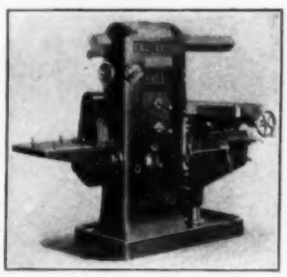


The machine was formerly made by the A. C. Mason Co., Inc., Paterson, N. J. It is built in both bench (Model E) and floor (Model F) types and with either one, two, three, four or six spindles, the illustration showing a multiple-spindle floor-type machine. It is fully equipped with ball bearings, and the bearings and moving parts are covered, the only visible rotating parts being the driving pulley and the nose of the spindle. The spindle is provided with a device for retaining the lubricating oil, a reservoir being incorporated in the sleeve. Oil which has passed through the lower bearings on the spindle is caught, when thrown outward, by the interior surface of the non-rotating sleeve, and then drops downward from the bottom of the sleeve, thus protecting the operator. Holes ⅛ in. in diameter can be drilled in steel.

Shaper, Crank
Samson Works, Berlin, Germany
"American Machinist," March 3, 1921

The gear for the link drive and its journal are made in two separate parts, the journal being of steel, hardened and ground. The coupling of the link and ram is pivoted. The ram runs between two steel gibs. The adjustment of the table feed is made by means of a pawl. The feed during reversal of the ram is actuated by two cams fitted on the main drive gear, and is transformed into the reciprocating rotation of a vertical feed shaft by means of a completely encased train of spur and bevel gears. Forced lubrication is provided for all main parts, by means of a pump feeding a constant jet of lubricant.

Milling Machine Drive, Individual Motor, Cleveland
Clark Mesker Co., 18511 Euclid Ave., Cleveland, Ohio
"American Machinist," March 3, 1921



The motor bracket and drive mechanism are built in two sizes, to fit the Nos. 1 and 2 milling machines. It is claimed that this direct-connected motor drive obtains the advantages of belt-driving by the incorporation of a friction clutch between the lower sprocket and the main drive-shaft. The grip of the clutch can be adjusted by a nut at the back of the clutch housing. The drive can be applied to the present models of belt-driven machines. The bracket is designed to support the motor high enough, so that it be free from the dirt of the floor. The sprockets and chain run in a bath of oil. A 2-in. Morse chain is used on the No. 1 machine, and a 2½-in. chain on the No. 2. The motor has a constant speed and runs at 1,200 r.p.m.

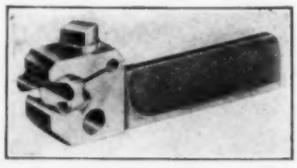
Rivet-Heating Machine, Electric
Elektrische Schweissmaschinen Gesellschaft, Charlottenburg 4, Germany
"American Machinist," March 3, 1921

The machine is intended for use in the erection of steel structures, and for boiler shops, shipyards and other industrial plants. The transformer is placed on a cast-iron table resting on legs equipped with rollers. In the front of the transformer are the electrodes. The regulating switch has six steps and is encased and mounted in the rear. The switching on and off of the current, and the movement of the electrodes for feeding and removing the rivets are actuated by the treadle. The machine is fed by a weak medium-tension alternating current, which is converted into a very strong low-tension current. This latter current passes through the rivet, which is put between the electrodes and is heated in a few seconds. The machine is made in two sizes, for rivets up to ¾ and 1¼ in., respectively. The smaller size of machine heats 400 rivets per hour.

Boring Tool, Small
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," March 3, 1921

The tool is suitable for use in small lathes. The toolbar is held to the shank by a swinging link that permits it to be raised and lowered, to accommodate various heights of center, without throwing it out of parallel. The link is simultaneously tightened upon the stud and upon the toolbar by means of a single screw. Three toolbars are provided with each holder. A split bushing is furnished to adapt the holder to a smaller size of toolbar. Extra bars can be made from drill rod.

Tool and Holder, "Twisto"
John H. Monstream, Hartford, Conn.
"American Machinist," March 3, 1921



The device is intended for use on lathes, planers and shapers, being adapted to general machining work. The cutting tool or bit resembles a three-lipped twist drill, it being provided with three helical grooves. The cutting is done on the ends of the bit, one edge cutting at a time. The bits are regularly furnished in lengths of 2 in., it being stated that there are 6¾ in. of length of cutting lip available for wear on each bit. When sharpening the tool, only the ends of it are ground. The bit is clamped in the holder in a horizontal position, a long bearing being provided in the holder, so that the bit is securely held. The holder is adapted to the use of disk tools. The shank of the tool passes through the hole used for the "Twisto" tool, and a stud passed through the lower hole in the holder serves to steady the edge of the disk.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

FRANK MCCARTHY has severed connections with the Youngstown Sheet and Tube Co., Youngstown, Ohio, to assume active duty as president and general manager of the Federal Iron Works in the same city. Mr. McCarthy served the Youngstown company for ten years.

W. J. LYNCH, who has been special steel plant representative of the Bonnot Co., Canton, Ohio, has been appointed manager of the Chicago district, with headquarters in the Continental and Commercial Bank Building, Chicago.

HOMER J. FORSYTHE, manager of the construction division of the engineering department of the Du Pont company, has been transferred to the position of assistant general manager of the Hyatt Roller Bearing Co. of Newark, N. J., a subsidiary of the General Motors Corporation. Mr. Forsythe was selected for this important position because of his wide experience in machine shop work and his ability to handle difficult problems in his line.

CHARLES R. POLLARD has resigned from the trade research division of the Goodyear Tire and Rubber Co., Akron, Ohio, to resume the office of secretary of the Alexander Milburn Co., Baltimore, Md. Mr. Pollard will take charge of the territorial development for the Milburn company's products.

EARL M. HARTRIDGE, president of the Allied Machinery Company de France, Paris, is in the United States for a few weeks' visit, making his headquarters at the office of the Allied Machinery Company of America, 51 Chambers St., New York City.

JOHN BOSSERT of the sales force of the Hart-Parr Co., Charles City, Iowa, has been transferred from the local offices to supervision of sales in the Southern States, with headquarters at Memphis, Tenn.

DONALD MCSKIMMON has resigned as purchasing agent of the S. W. Card Manufacturing Co. of Mansfield, Mass., to accept the position of sales manager of the J. T. Slocomb Co., Providence, R. I.

FREDERICK H. PAYNE of Greenfield, Mass., president of the Greenfield Tap and Die Corporation of Greenfield, has recently been chosen president of the S. A. Smith Manufacturing Co. of Brattleboro, Vt. The Smith company manufactures toys and toy machinery.

J. R. STONE, of Detroit, Mich., for many years identified with the machinery and tool business in this country, has returned from a six months' trip to South America, where he has been investigating the field for the new company which he will organize. He reports a large and fertile field for American trade.

Obituary

THOMAS L. SMITH, founder, director and chief stockholder of the T. L. Smith Co., died on April 29 at his home in Milwaukee. Mr. Smith brought out a number of successful inventions during his life, and is known as the inventor and manufacturer of the line of Smith tilting mixers. Because of his activities in designing and producing mixers, pavers, excavators, crushers, etc., his career has a most unique significance in the field of construction and engineering. In 1920, Iowa State College conferred upon him the Honorary Degree of Doctor of Engineering, in recognition of his accomplishments. The Smith Engineering Works, Milwaukee, manufacturer of Tel-smith rock and ore crushers, is another company organized and developed to a high degree of success by the inventive genius and business ability of T. L. Smith.

ROBERT L. BRIDGMAN, for thirteen years New England representative of the L. S. Starrett Co., of Athol, Mass., died at his home in Belchertown, Mass., on May 7. He was sixty-seven years of age. Previous to joining the Starrett forces he was the representative of the Athol Machine Co., for over thirty years.

ADOLPH SORGE, JR., Chicago representative of the H. S. B. W.-Cochrane Corporation of Philadelphia, Pa., died on May 5. Mr. Sorge was prominent in Western engineering circles and is credited with many improvements and inventions in steam plant and boiler construction.

D. W. DWIRE, foreign representative of the Yale & Towne Manufacturing Co., Stamford, Conn., died at the Bronx Sanitarium, in New York, on April 15. Death was due to peritonitis, secondary to an attack of typhoid fever. Mr. Dwire's territory consisted of Porto Rico, Santo Domingo, Trinidad, the Guianas, Venezuela, and the Lesser Antilles.

CHARLES H. MORSE, founder of Fairbanks, Morse & Co., scale manufacturers, died at his winter home in Florida on May 5. He was 87 years old. Mr. Morse was born in St. Johnsbury, Vt., but spent the best part of his life in Chicago, where he started the scale manufacturing business which is known throughout the country.

Trade Catalogs

Punch and Shear. The Cleveland Punch and Shear Works Co., Cleveland, Ohio. Four-page circular illustrating and describing a complete line of punches and shears as manufactured by this company.

Gears. Boston Gear Works, Quincy, Mass. Catalog G-1, a complete list of Boston gear products with specifications and prices.

Thread Lead Variator. The Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa. A four-page illustrated circular describing the thread lead variator and the perfected multi-graduated thread grinder for attachment to a lathe.

Internal Micrometer. John Bath & Co., Inc., Worcester, Mass. Bulletin No. 10 describing the latest creation in a line of internal measuring instruments.

Johnson Friction Clutches. The Carlyle Johnson Machine Co., Manchester, Conn. A stock list showing a comprehensive assortment of sizes of Johnson friction clutches.

Flexible Shaft Equipment. The Hergi Manufacturing Co., Bridgeport, Conn. A sixteen page 6 x 9-in. catalog devoted to a description of Hergi portable electric machinery, including drills, grinders, screwdrivers, hammers and various attachments.

Air Compressors and Vacuum Pumps. Pennsylvania Pump and Compressor Co., Easton, Pa. A sixteen page illustrated catalog, No. 101, describing a line of air compressors and vacuum pumps. Tables of operation and specifications for all sizes and types are included.

Power Transmission. The Chicago Pulley and Shafting Co., Chicago, Ill. Circular entitled "Handicapped Power Transmission Penalizes Production," which treats of the products of this company. Many types of ball bearing power transmitting appliances, pulleys, shafting and clutches are described briefly.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A manufacturer in Quebec desires to purchase metal stamping machines for stamping metal novelties. Quotations should be given f.o.b. port of shipment. No reference offered. No. 34866.

A Commercial agency firm in France desires to secure an exclusive agency for the sale of automobiles and agricultural machinery. Correspondence should be in French. References. No. 34867.

A mercantile firm in Manchuria desires to secure the representation of manufacturers for the sale of enamel ware, hardware, scales, engineers' supplies and tools; machinery for metal working, milling, pipe cutting and threading, sawmills, and woodworking; machine-shop equipment and supplies for building, sewerage and water, and heating systems; and pumps, belting, iron, steel, tin and zinc. References. No. 34871.

Forthcoming Meetings

The Society of Automotive Engineers, 29 West 39th St., New York, announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

The American Railway Association will hold the Spring meeting of its Purchases and Stores Section at the Blackstone Hotel, Chicago, June 9 to 11, and the Spring meeting of its Mechanical Section at the Drake Hotel, Chicago, June 15 and 16.

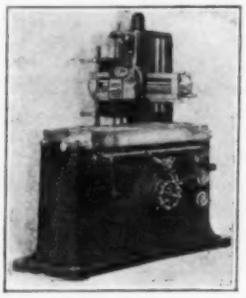
The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

The eighth annual convention of the American Drop Forge Association and the Drop Forge Supply Association will be held at Chicago, Ill., June 22 to 24 with headquarters at the Congress Hotel.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Planer, Crank, Open-Side, Coulter
Automatic Machine Co., Bridgeport, Conn.
"American Machinist," March 10, 1921



The machine is similar to that described on page 819, Vol 50, of the *American Machinist*, being particularly adapted to toolroom work. The combination clutch and brake mechanism is operated from the front of the machine, and by means of it the table can be stopped and started instantly without change of the motion of the motor or countershaft. It is stated that it contains the advantages found in a shaper, such as the quick-return stroke, variable speeds, and the ability to cut to a shoulder, with the accuracy and table capacity of a planer. The maximum stroke can be taken anywhere on the table by merely positioning the table under the tool without disturbing the work, and the maximum stroke can be taken with the same degree of accuracy as a shorter one.

Grinders, Electric, Bench and Floor
Glow Electric Co., 219 Walnut St., Cincinnati, Ohio.
"American Machinist," March 10, 1921

The machines are made in a range of sizes in both bench and floor types, and are adapted for grinding, buffing and polishing. The device equipped with scratch brushes is adapted for brushing and scouring small articles, being especially intended for the use of manufacturing jewelers. The machine is built in capacities of ½, 1, 3 and 5 hp., for either direct or alternating current, and either with or without pedestals. The head is totally inclosed and is dustproof, its contour enabling it to be easily kept clean. The grinders are equipped with heavy cast-iron guards and adjustable work rests. The 3- and 5-hp. machines are furnished with push-button controllers mounted inside the pedestal. The bench machine in the smaller sizes is equipped with a snap switch, mounted in the frame of the motor, so as to make the switch convenient for use and to protect it.

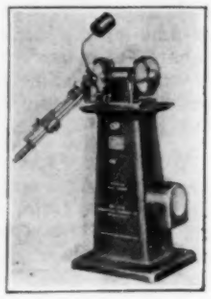
Drilling Machine, Sensitive, Floor-Type, "Pecorp"
Providence Engineering Corporation, 5 Nassau St., New York, N. Y.
"American Machinist," March 10, 1921

The machine, formerly known as the Mason-Widmer drilling machine, is built in two styles, the Model K having a larger table than the Model H. It is fully equipped with ball bearings. The spindle is provided with a device for retaining the lubricating oil. Because of the fact that the non-rotating sleeve extends below the bearings, oil which has passed through the bearings drops straight downward from the bottom of the sleeve, instead of being thrown outward and upon the operator. The belt can be shifted by means of a crank on the front of the head. Two idlers tighten the belt, which is under tension only when the load is applied, thus saving wear on the belt. The machine can be driven by means of a belt or either horizontal or vertical motors, the illustration showing the latter type. It can be made with any number of spindles up to eight.

Indicator, Test
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," March 10, 1921

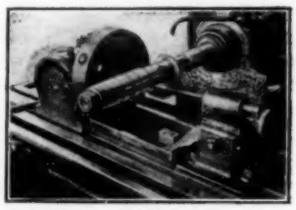
The rectangular shank is split so that the tool may be held in the toolpost of a lathe and clamped against turning by the tool post screw. The stock can be turned easily within the shank, so as to bring the graduated scale into any position convenient for reading. The little bellcrank lever is also adjustable as to position, or may be removed and the implement presented to the work at a right angle. The bell crank is held in position by a spring clamp, and may be put on and taken off without the aid of tools of any kind. Its use allows the indicator to be presented to the work from different angles. Each graduation on the scale represents a motion of 0.001 in. of the sensitive point.

Grinding Machine, Drill, Semi-Automatic, No. 20B
Bellevue Industrial Furnace Co., Detroit, Mich.
"American Machinist," March 10, 1921



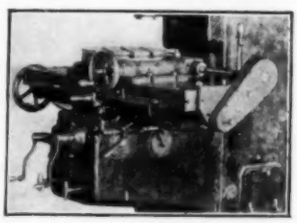
The machine is a self-contained unit with its driving motor located in its pedestal and partly inclosed by the projecting housing on the right of the pedestal. It is equipped with a two-step cone pulley for the drive to the spindle. The machine can also be arranged so that it can be driven from a line shaft. The machine grinds on the periphery of the wheel instead of on the side. It can be equipped with a carriage for grinding left-hand drills, as well as right. Drills with two, three, four or more lips can also be ground. The machine is made in two sizes. The smaller size handles drills from $\frac{1}{16}$ to $1\frac{1}{4}$ in. in diameter, the smaller sizes of drills being held in any standard form of chuck. The larger machine grinds drills from $\frac{3}{8}$ to 3 in. in diameter.

Center, Tail, Adjustable
New Britain Tool & Manufacturing Co., Harvard St., New Britain, Conn.
"American Machinist," March 10, 1921



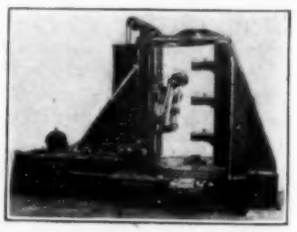
This center is a complement to the indexing head made by the same concern and described on page 143, Vol. 51, of the *American Machinist*. The height of the center can be adjusted within reasonable limits, to furnish an outboard support when fluting taper reamers or similar work. The bracket holding the center is secured in place on the base by only one bolt, so that the center can be swivelled to the desired angle and clamped. The device is here shown in position on the table of a milling machine.

Table, Rotary, Milling Machine, Cleveland
Clark-Mesker Co., 18511 Euclid Ave., Cleveland, Ohio.
"American Machinist," March 10, 1921



There are two sizes of the table, designated as Nos. 1 and 2, for the corresponding sizes of milling machines. It can be operated either by hand or by power feed. There are 16 changes of power feed, controlled from the front of the knee by the same mechanism that controls the feed changes for the sliding table. The driving worm is made with coarse pitch and runs in oil. Its end thrust in each direction is taken care of by ball thrust bearings, and means are provided for taking up the wear. The table rests in a taper bearing. Its surface is slotted with T-slots of the same size as those in the milling machine table. The rotating table is surrounded by a coolant-collecting trough formed by a rib cast on the base.

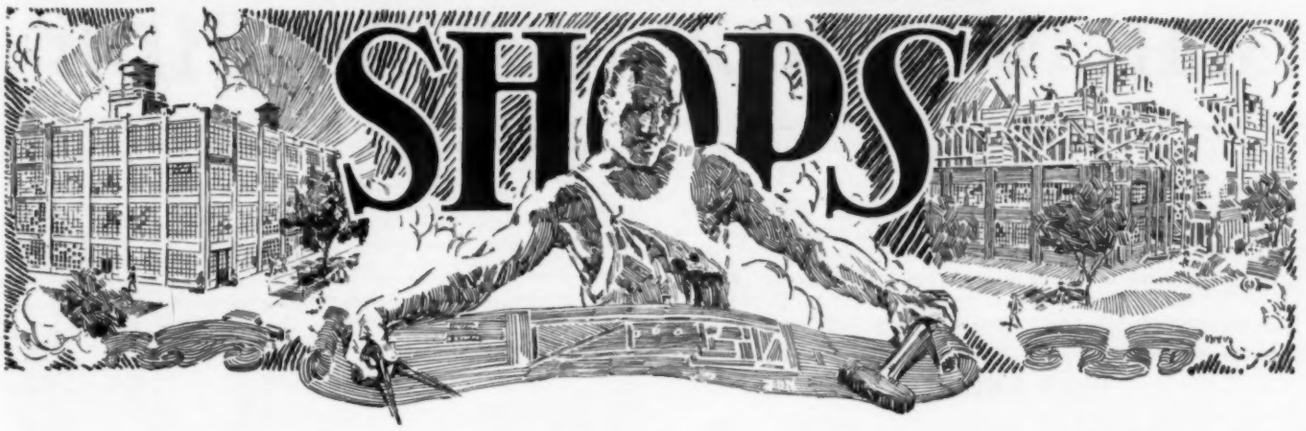
Hobbing Machine, Gear, 13 Ft.
J. E. Reinecker, A.G., Chemnitz, Germany
"American Machinist," March 10, 1921



The machine is built for hobbing gears up to 13 ft. in diameter and 6 ft. in width, being used on the reduction gears for turbine-propelled ships. The table, which will carry a load of 33 tons, has secured to it a large indexing gear. The change gears of the indexing mechanism are at the extreme left of the gear box. Both the main vertical housing and the counter-weighted saddle mounted on it are provided with hand and power mechanisms for traversing and elevating. The toolslide swivels on the saddle so that the hob may be adjusted to any desired angle. There is a continuous transverse movement of the hob while it is in action, so that the full cutting width is in service, and wear is practically uniform. When it is desired to cut pinions, the upright shown mounted on an extension of the base is used.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. J., Newark—The Essex Fdry., Murray St.—one 42 in. Bullard vertical turret lathe of New Era type.

N. Y., Buffalo—The L. G. Schoeflin Auto Repairs, 80 West Mohawk St.—universal electric drill up to ½ in. (Used and in good condition.)

N. Y., Springville—S. E. Spencer Machine Shop—milling machine, (used), and an acetyline cutting torch.

Fla., St. Petersburg—The Marine Ways Machine Co., 236 7th Ave., J. W. Appleby, Proprietor—bench lathe, 6 to 9 in. swing (used and in good condition).

Ga., Cedartown—The Brewer Automobile Headlight Co., I. L. St. Clair, Pres.—machine tools and machinery for the manufacture of automobile headlight equipment.

Ga., Columbus—The Centenial Cotton Gin Co., K. R. Lummus, Secy.—machine tools and machinery for the manufacture of cotton gin machinery, capacity to be 3 gins per day.

La., New Orleans—The Dixie Machine Welding & Metal Wks., Inc., 1031 Annunciation St., J. Szodomka, Proprietor—medium size milling machine and medium size shaper. (New or used.)

La., New Orleans—The F. H. Koretke Brass & Mfg. Co., Ltd., 922-924 Magazine St., E. E. Gosselin, Vice Pres.—turret lathes and screw machines for brass work.

Ill., Chicago—The Chicago, Rock Island Pacific Ry. Co., La Salle Station, F. D. Reed, Genl. Purch. Agt.—
Two 16 in. lathes.
One 48 in. radial drill.
Two 1⅝ in. capacity screw machines.
One combination punch and shear on truck wheels. (New.)

Ill., Springfield—The Bd. Educ., M. G. Owens, Pres., Ferguson Bldg. — manual training equipment for high school.

Mich., Detroit—F. Koss, 2281 Hunt St.—screw cutting lathe (Used preferred).

Mich., Lansing—The Lansing Stamping Co., South Penn St.—One single spindle, belt driven disk grinder to handle a surface 15 x 25 in., equipped with one universal lever feed table; similar to a No. 21, 36 in., G. type Besley. (Used.)

O., Canton—The Arctic Ice Machine Co., Market Ave., South and Penn. Ry.—
One 15 ton electric traveling crane from 48 to 50 ft. span.
One 30 in. swing lathe to take about 12 ft. between centers, direct connected, etc.
One 24 in. swing lathe to take about 10 ft. between centers, direct connected, etc.

O., Cleveland—The Fishel & Marks Co., Ft. of Krakov Ave., Iron and Steel Workers—
Plate squaring shear complete with driving motor with capacity for cutting ¼ in. thickness.
Plate squaring shear, complete with driving motor with capacity for cutting ¼ in. thickness.
Plate squaring shear complete with driving motor with capacity for cutting ¾ in. to 1 in. thickness.
Length of blades for all these shears to be as long as possible with gaps sufficiently deep so that widths 24 in. to 36 in. could be cut on same.

O., Columbus—The Columbus Forge & Iron Co., Foot of West First Ave., D. W. Singleton, Secy. and Treas.—Three or four large steam drop hammers and presses.

Wis., Grafton—Weber & Hoffman, E. Weber, Purch. Agt.—lathe and drill press.

Wis., Milwaukee—The Badger Packard Machinery Co., 133-139 West Water St.—
No. 75½ Bliss straight-side press.
No. 78½ Bliss straight-side press.
One 36 in. x 28 ft. lathe. (Used.)
One ⅞ in. x 12 ft. capacity squaring shear.
One 8 ft. x ¼ in. steel bending brake, similar to a No. 186 Chicago.
One 8 ft., 10 ft. or 12 ft., 16 gage capacity steel bending brake.
One 22 in. x 22 ft. lathe. (All new.)

Wis., Milwaukee—J. R. Lamboy, 2702 St. Paul Ave.—small lathes, jigs, high speed drills, bench tools and 3 grinders, 14 in. to 16 in. wheel, 2½ in. base.

Wis., North Milwaukee—R. Lohse, Hopkins Rd., (Machinist)—Six screw machines, 4 millers, 14 in. to 22 in. several shapers—none smaller than 6 in., radial drill press 20 in. to 24 in. and several lathes.

Ia., Perry—The Bd. Educ., W. H. Wimger, Secy. — manual training equipment for school.

Mo., Joplin—The E. A. Martin Machinery Co.—machine shop tools.

Mo., St. Louis—The Crescent Steel Co., 515 West Tessen St.—A 10 ft. power brake.

S. D., Sioux Falls—The Bd. Educ., A. Ayres, Pres.—manual training equipment for high school.

Ont., Exeter—The Ontario Flax Mills, L. Davis, Mgr.—$15,000 worth of boiler, engine and flax machinery.

Ont., London—The Car Owners Garage Co., G. A. Miller, Mgr.—complete garage and repair shop equipment.

Ont., Ottawa—Beeby & Aikins, Ltd., 202 Jackson Bldg.—equipment for the manufacture of stoves, ranges and furnaces.

Ont., Strathroy — W. A. Hodgins—complete garage and repair shop equipment.

Que., Montreal—A. Trudeau, 1116 St. Denis St.—lathe and other garage equipment.

Machinery Wanted

Conn., Middletown—The Millbrook Dairy Co., 4 Main St.—dairy equipment.

R. I., Providence—S. Sweet, Willard Ave. —equipment for bakery.

N. Y., Buffalo—The city, Municipal Bldg., will receive bids until May 31 for conveying machinery. F. T. Reynolds, Bldg. Comr.

N. Y., Buffalo—The Jakiel Lumber Co., 1247 Bway., J. M. Jakiel, Pres.—machinery for planing mill.

Pa., Reading—The Brown Eng. Co., 123 North 3rd St.—Platform scale with a capacity of 15 to 20 tons known as the truck type.

O., Columbus—The Lilles Laundry, 1011 West Rich St., P. M. Lilles Pres.—laundry machinery.

Wis., Marshfield—Blum Bros.—machinery for the manufacture of wooden cheese boxes.

Wis., Sheboygan Falls—The Falls Roller Mills Co., c/o E. Gonzerbach, Mgr.—mill equipment.

Ont., Kingsville—Brown & Wigle, E. A. Brown, Mgr.—equipment and machinery for woolen mill.

Ont., Laforest—The Marshay Lumber Co. —complete sawmill equipment.

Ont., New Liskeard — Black, Fasken & Hennessey, c/o A. Fasken, Pres., Excelsior Life Bldg., Toronto—pulp mill machinery.

Ont., Peterborough—T. H. Kennedy — artificial ice machinery.

Ont., Windsor—E. B. Winter and A. A. Little, 35 Elm Ave.—refrigerating equipment.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—B. A. Sellew, Archt. and Engr., 721 Main St., will soon award the contract for the construction of a 1 story, 30 x 120 ft. garage for S. F. Hines, 20 Wethersfield Ave. Estimated cost, $30,000.

Conn., New Haven—S. Konick, 277 Dixwell Ave., has awarded the contract for the construction of a 1 story, 50 x 65 ft. garage on Dixwell Ave. Estimated cost, $10,000.

Conn., Norwalk—S. Kantor, 65 Cross St., will soon award the contract for the construction of a 1 and 2 story, 80 x 160 ft. garage and service station on Isaac St. Estimated cost, $40,000. H. W. Mather, 79 Washington St., Archt. Noted May 19.

Mass., Boston—The Meisel Press Mfg. Co., 944 Dorchester Ave., is having plans prepared for the construction of a 1 story, 180 x 300 ft. machine shop on Dorchester Ave. Estimated cost, $250,000. MacNaughton & Cleverden, 19 Congress St., Archts.

Mass., Dorchester—T. G. Buckley, 690 Dudley St., has awarded the contract for altering garage building on Dudley St. Estimated cost, $40,000.

Mass., Lowell—Katz Bros., 202 French St., will build a 1 story, 98 x 99 ft. garage on Armory St. Estimated cost, $50,000.

Mass., Lowell — J. T. Meyers, Middlesex St., will build a 1 story, 35 x 66 ft. garage on Green St. Estimated cost, $10,000.

Mass., Salem—O. Bouchard, 22 Willow Ave., will build a 1 story, 55 x 150 ft. garage on Washington St. Estimated cost, $20,000.

Mass., Shelburne Falls—A. Bruffee, Athol, will build a 1 story, 40 x 90 ft. garage and 40 x 45 ft. ell addition for a repair shop on Mohawk Trail. Estimated cost, $30,000.

Mass., Springfield—The Gulf Refining Co., Albany St., will build a 1 story, 70 x 70 ft. garage. Estimated cost, $25,000. Noted May 12.

Mass., Willimansett—S. Boisvert, Chicopee St., will build a 1 story, 30 x 90 ft. garage on Chicopee St. and Warrington Ave. Estimated cost, $15,000

THE WEEKLY PRICE GUIDE

This Week's Market

Business in the steel trade is extremely light. Warehouses report that deliveries from mills are poor, owing to reduced production. Orders are so small that mills accumulate them until there are enough to warrant changing rolls. Little improvement is expected before September.

Metal market dull, but no worse than a week ago.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.75
Northern Basic	26.52
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75	26.26
Virginia No. 2	†27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern, sil 2.25@2.75	30.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.46
Basic	24.46
Bessemer	26.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York		Cleveland	Chicago
	Warehouse Jersey City	Delivered		Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.80	5.20
Nos. 22 and 24	3.85	5.00	4.85	5.25
No. 25 and 26	3.90	5.05	4.90	5.30
No. 28	4.00	5.15	5.00	5.40
Galvanized				
No. 10 and 11	4.00	5.30	5.00	5.70
No. 12 to 14	4.10	5.40	5.10	5.80
Nos. 17 and 21	4.40	5.70	5.40	6.10
Nos. 22 and 24	4.55	5.85	5.55	6.25
No. 26	4.70	6.00	5.70	6.30
No. 28	5.00	6.25	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb.	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	50%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 1/16, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Copnered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	8.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	62½	50	⅛	33½	18½
			¼ to 1¼	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.87½
Tin in 5-ton lots	33.50
Lead	5.62½
Zinc	5.87½
ST. LOUIS	
Lead	5.22½
Zinc	5.47½

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.50	22.00	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	16.25	21.00	20.75
Brass pipe	20.00	24.00	24.50
Solder (half and half) (case lots)	24.00	22.75	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	18.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 11.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	12.15	12.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.50
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	8.00	7.65
Lead, heavy	3.25	4.00	3.00
Lead, tea	2.00	3.00	2.85
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	4.50
No. 1 yellow brass turnings	5.00	5.00	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75-10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60-10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ¼ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	50-10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	20.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.75	$0.82
5-gal. cans	.76*	.85	1.07

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Mass., Worcester—The Rockwood Sprinkler Co., 38 Harlow St., will alter its factory. Estimated cost, $15,000.

MIDDLE ATLANTIC STATES

Pa., Forty Fort (Kingston P. O.)—The Delaware, Lackawanna & Western R. R., Coal Mining Dept., Scranton, has awarded the contract for the construction of a 1 story, 83 x 92 ft. forge and machine shop. Estimated cost, $30,000. J. Reynolds, Supt.

Pa., Pittsburgh—E. A. Harrigan & Son, 520 Robinson St., Northside, are having plans prepared for the construction of a 2 story, 56 x 68 ft. garage and machine shop. Private plans.

MIDDLE WEST STATES

Ill., Elgin — Wait & Ross, Undertakers, are having plans prepared for the construction of a 2 story, 74 x 77 ft. building including garage. Estimated cost, $75,000. G. E. Morris, Sherwin Bldg., Archt.

Ill., Elmhurst—The Cregar Co., 144 York St., is having plans prepared for the construction of a 1 story, 50 x 135 ft. garage. Estimated cost, $40,000. E. N. Braucher, 6 North Clark St., Chicago, Archt.

Ill., Galesburg—The Mackmer Motor Co. will build a 1 story, 112 x 170 ft. garage and salesroom. Estimated cost, $90,000.

Ill., Paxton — L. Rasmussen, 355 West Franklin St., will build a 2 story, 50 x 160 ft. garage. Estimated cost, $75,000.

Ind., Vincennes—The Dyer Realty Co. has awarded the contract for the construction of a 1 story, 150 x 160 ft. garage. Estimated cost, $75,000.

O., Cleveland—The Armature Coil Equipment Co., c/o A. Fathauer, 3202 Scranton Rd., has awarded the contract for the construction of a 1 story, 30 x 40 ft. factory. Estimated cost, $40,000.

O., Cleveland—The Lorain & Clark Garage, c/o A. Barth, 8901 Clark Ave., has had plans prepared for the construction of a 2 story, 100 x 124 ft. garage on the corner of Lorain and Clark Aves. Estimated cost, $60,000. A. E. Keller, 1298 Carlyon Rd., East Cleveland, Archt.

O., Cleveland—The R. W. MacMurphy Co., 8755 Bway., plans to build a 1 story garage. Estimated cost, $40,000. R. W. MacMurphy, Pres.

O., Cleveland—P. M. Platten, 348 Engineers Bldg., plans to build a 1 story, 45 x 137 ft. store and garage building on East 133d St. and Miles Ave. Estimated cost, $40,000. J. L. Cameron, 10406 Euclid Ave., Archt.

O., Cleveland—The Woodland Ave. Corp., c/o M. K. Lertzman, 5608 Woodland Ave., plans to build a 1 story, 60 x 150 ft. garage on Kinsman Rd. near East 75th St. Estimated cost, $40,000. N. Altschuld, 5116 Woodland Ave., Archt.

O., Dayton — B. H. Zeihler, 415 South Main St., plans to build a 2 story, 42 x 195 ft. auto sales and garage building on South Main St. Estimated cost, $50,000.

O., Madison—The Lyon King Implement Co. plans to build a 50 x 200 ft. factory for the manufacture of garden implements, tractor attachments, etc. Estimated cost, $30,000. W. E. Arnold, Pres.

Wis., Cedarburg—The E. & W. Mfg. Co., 325 Oregon St., Milwaukee, has awarded the contract for the construction of a 1 story, 60 x 160 ft. factory for the manufacture of trucks and trailers on Main St. Estimated cost, $80,000. Noted March 24.

Wis., Milwaukee—The W. F. Horn Co., 150 8th St., has awarded the contract for the construction of a 2 story, 50 x 150 ft. garage on 5th St. Estimated cost, $75,000.

Wis., Milwaukee—The Main Express Co., 117 Oneida St., plans to build a 1 story, 60 x 120 ft. garage on Market St. Estimated cost, $75,000.

Wis., Platteville—The Fiedler Motor Co. has awarded the contract for the construction of a 1 story, 100 x 136 ft. garage. Estimated cost, $40,000. Noted May 12.

STATES WEST OF THE MISSISSIPPI

Mo., Joplin—The E. A. Martin Machinery Co. has had plans prepared for the construction of a 2 story sales building and machine shop on 5th and School Sts. E. A. Martin, Pres. Guieman & Martinie, 420 North Wall St., Archts.

Mo., St. Louis—The Eagle Motor Truck Co., 6154 Bartmer Ave., has purchased a site and plans to build a 1 story, 50 x 100 ft. factory. Estimated cost, $50,000. Private plans.

Wyo., Casper—The city has awarded the contract for the construction of a 2 story, 75 x 140 ft. fire station and garage on South David St. Estimated cost, $75,000. Noted Feb. 10.

Wyo., Casper—The Ohio Oil Co. has awarded the contract for the construction of a 1 story, 114 x 140 ft. garage and warehouse on Market St. between B and C Sts. Estimated cost, $75,000.

WESTERN STATES

Wash., Seattle—The School Bd., Central Bldg., has awarded the contract for the construction of a 3 story, 216 x 337 ft. high school to include complete shops, etc., on 15th St., Northeast and East 66th St. Estimated cost, $820,825.

CANADA

Ont., Hamilton — The Patricia Photo Players, Ltd., is having plans prepared for the construction of a 1 and 2 story, 275 x 300 ft. photo studio and garage building. Estimated cost, $200,000. Stewart & Jolley, 340 Lester Bldg., Archts.

Ont., London—The Car Owners Garage Co. will soon award the contract for the construction of a 1 story, 100 x 150 ft. garage on York St. Estimated cost, $40,000. G. A. Miller, Mgr. Watt & Blackwell, Bank of Toronto, Archts.

Ont., Ottawa—Beeby & Aikins, Ltd., 202 Jackson Bldg., plans to build a stove factory. Estimated cost, $150,000. Architect not yet appointed.

Ont., Strathroy—W. A. Hodgins will receive bids until June 1 for the construction of a 1 story, 50 x 100 ft. garage on Frank St. Estimated cost, $25,000.

Que., Montreal—A. Trudeau, 1176 St. Denis St., will receive bids until June 1 for the construction of a 2 story, 35 x 100 ft. garage on St. Denis St. Estimated cost, $20,000.

Man., Brandon—The Imperial Oil Ltd. plans to construct a 50 x 200 ft. marketing plant to include a warehouse, garage, etc. Estimated cost, $250,000. D. S. Paterson, Mgr.

General Manufacturing

NEW ENGLAND STATES

Conn., Bristol—The Horton Mfg. Co., 187 North Main St., has awarded the contract for the construction of a 3 story addition to its plant for the manufacture of fishing rods and tackle. Estimated cost, $40,000.

Conn., Hartford—B. A. Sellew, Archt. and Engr., 721 Main St., will soon award the contract for the construction of a 1 story, 40 x 104 ft. addition to the grain plant for the Garber-Northam Grain Co., 409 Windsor Ave. Estimated cost, $25,000.

Conn., Hartford—The Underwood Typewriter Co., Inc., 581 Capitol Ave., will build a 1 story addition to its factory. Estimated cost, $15,000.

Conn., Middletown—The Millbrook Dairy Co., 4 Main St., is having plans prepared for the construction of a 3 story, 50 x 60 ft. dairy plant on Church and Broad Sts. Estimated cost, $40,000. Buck & Sheldon, Inc., 60 Prospect St., Hartford, Archts. and Engrs.

Conn., Norwalk—C. H. Harris Inc., 136 West 24th St., New York City, is having plans prepared for the construction of a 1 story, 100 x 220 ft. plant for the manufacture of windshields and other glass products on Main St. Estimated cost, $100,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archts. and Engrs. Noted May 19.

Me., Winthrop—The Bailey Oil Cloth Co. has awarded the contract for the construction of a factory to include a 3 story, 50 x 145 ft., 3 story, 95 x 120 ft. and a 1 story, 80 x 98 ft. buildings. Estimated cost, $250,000. Noted May 19.

Mass., Taunton — The Presbrey Stove Lining Co., 212 Somerset Ave., has awarded the contract for the construction of a 1 and 2 story addition to its plant. Estimated cost, $30,000.

R. I., Providence—H. Marshak, Archt., 310 Strand Bldg., will soon award the contract for the construction of a 1 story, 30 x 100 ft. bakery for S. Sweet, Willard Ave.

R. I., Woonsocket—Lepoutre Bros. have awarded the contract for the construction of a 3 story, 100 x 135 ft. weave shed, and a 1 story, 41 x 133 ft. finishing building on Manville Rd. Estimated cost, $175,000. Noted April 7.

MIDDLE ATLANTIC STATES

Md., Baltimore—J. Thomas & Sons, Inc., (Lumber) 818 Leadenhall St., has awarded the contract for the construction of two 2 story, 113 x 118 ft. mill buildings and two 20 x 22 ft. sheds. Estimated cost, $50,000.

N. J., Audubon—The Hadden Label Co., Hadden Heights, has awarded the contract for the construction of a 1 story, 20 x 75 ft. factory on Railroad St. Estimated cost, $15,000.

N. J., Trenton—The Standard Inlaid Mfg. Co., East State St., plans to build a 1 story, 50 x 300 ft. drying room linoleum factory to replace the one recently destroyed by fire. Estimated cost, $75,000. Private plans.

N. Y., Buffalo—J. M. Jakiel, 1247 Bway, will build a 2 story, 34 x 50 ft. planing mill on Bway. Estimated cost, $10,000.

SOUTHERN STATES

Ga., Atlanta—The Capital City Laundry has had plans prepared for the construction of a 3 story, 50 x 100 ft. laundry on the corner of Boulevard and Cain Sts. F. Fauss, Pres. J. J. Chase, 140 Peachtree St., Archt.

Va., Richmond—The Old Dominion Beveridge Co., West Broad St., has awarded the contract for the construction of a 3 story, 40 x 64 x 130 ft. factory on Broad and Kenny Sts. Estimated cost, $75,000.

W. Va., Morgantown—The United States Window Glass Co. plans to enlarge its plant here or build a new unit. H. E. DeVaughn, Chief Engr.

MIDDLE WEST STATES

Ill., Bloomington — The Illinois Oakoal Corp. has awarded the contract for the construction of an oakoal plant. Estimated cost, $100,000.

Ill., Chicago—E. W. Bredemeier & Co., 213 North Morgan St., has had plans prepared for the construction of a 3 story, 125 x 140 ft. printing plant on Honore and Van Buren Sts. Estimated cost, $225,000. Berlin, Swern & Randall, 19 South La Salle St., Archts.

Ind., Columbia City — The Columbia Woolen Mills plans to build an addition to its factory. Estimated cost, $200,000. Private plans.

Ind., Dunkirk—The Indiana Glass Co. has awarded the contract for the construction of a 1 story, 110 x 146 ft. factory. Estimated cost, $75,000.

Ind., Lafayette—The Lafayette Printing Co. has awarded the contract for the construction of a 3 story, 40 x 75 ft. printing plant. Estimated cost, $75,000.

O., Ashtabula—The Silurium Mfg. Co., Sloan Bldg., Cleveland, plans to build a 1 story factory for the manufacture of clay products. Estimated cost, $500,000. E. Steinbrenner, Pres.

STATES WEST OF THE MISSISSIPPI

Mont., Billings — The Montana Refining Co. is having plans prepared for the construction of an oil refinery to have a 1,000 lb. capacity. Estimated cost, $120,000. R. Molt, Pres.

Mont., Eureka—The Lincoln Co. Bd. of Comrs., is having plans prepared for the construction of a 150 x 150 ft. chemical factory for the manufacture of products used in soft drinks and baking powders on the Fair Grounds, here. Estimated cost, $90,000. L. C. Klenck, Libby, Mont., Clk.

CANADA

Ont., Peterborough — T. H. Kennedy has awarded the contract for the construction of a 1 story, 50 x 100 ft. ice manufacturing plant. Estimated cost, $35,000.

Ont., Toronto — The Provincial Government, Dept. of Pub. Hwy. plans to build a cement plant to have an annual capacity of 300,000 bbls. G. Hogarth, Parliament Bldg., Engr. The Legislature voted $1,000,000 for the project.

Ont., Windsor—E. B. Winter and A. A. Little, 35 Elm Ave., will receive bids until June 4 for the construction of a 2 story, 50 x 200 ft. market building to include a refrigerating plant on Quellette Ave. Estimated cost, $150,000.